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Mechanical Lapping

CONTROLLED FINISH ON JOURNALS
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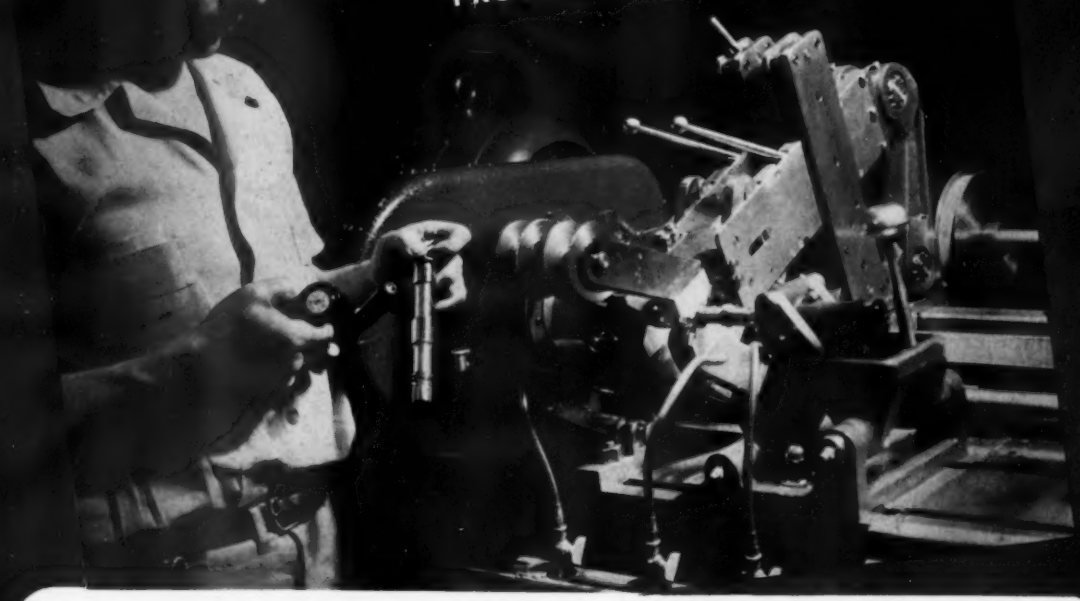
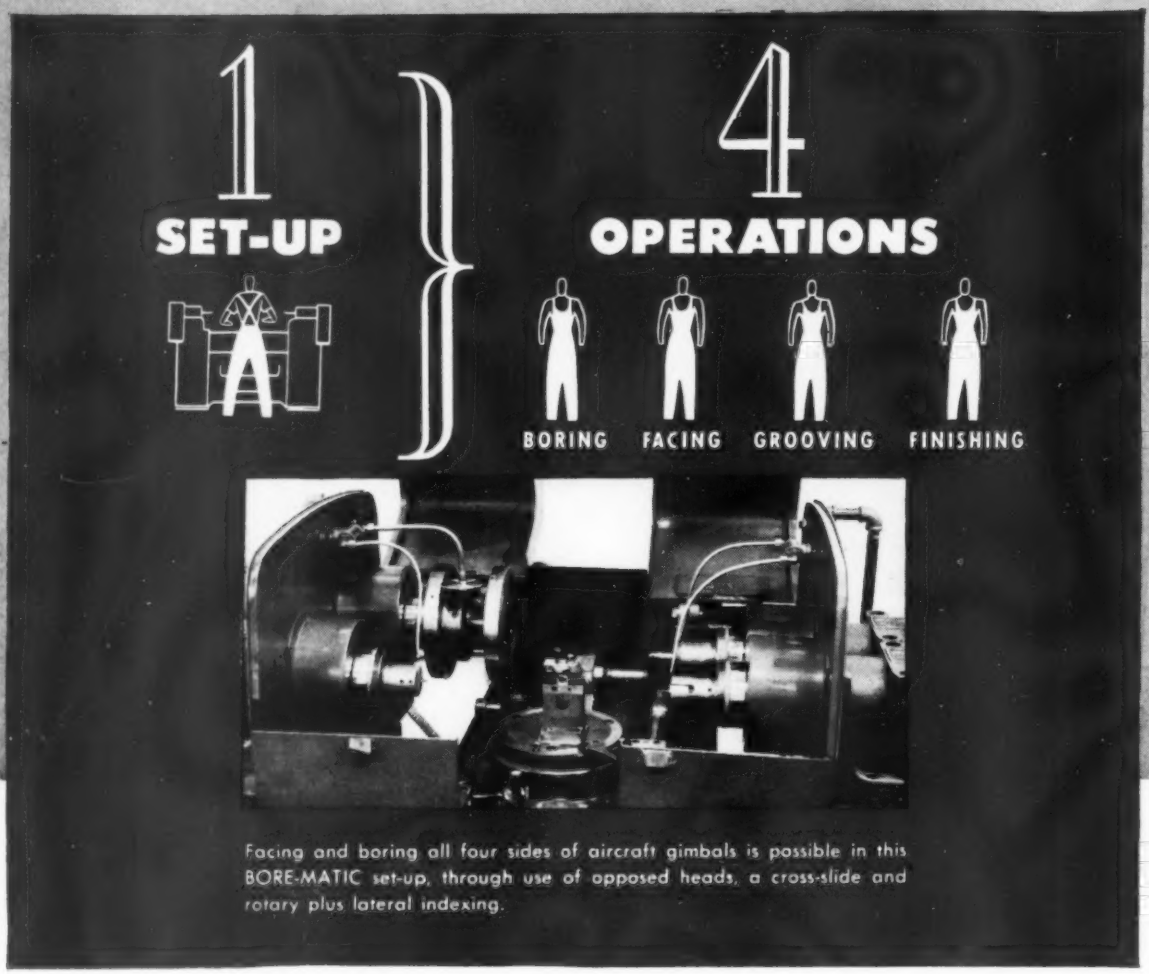


- *Inspection Stations Insure Accuracy of Piston Rings*
- *Selection and Application of Twist Drills*
- *Conveyors Aid in Assembly of Fuel Tanks*

MULTIPLY *Your* MANPOWER WITH A BORE-MATIC!



Facing and boring all four sides of aircraft gimbals is possible in this BORE-MATIC set-up, through use of opposed heads, a cross-slide and rotary plus lateral indexing.

Certainly these are no days to have your skilled men making unnecessary set-ups. That's why this example of a Heald BORE-MATIC engineered for a particular production job, should interest you. It permits making 1 set-up do for as many as 4 precision operations.

More operations per set-up boosts production. But more than that, with a BORE-MATIC you get improved relative accuracy of multiple surfaces. You decrease down time. Floor space is conserved. All-round versatility permits your BORE-MATIC to handle boring, turning, facing, chamfering, grooving, and fly-cutting. You can machine straight and taper surfaces; curves and irregular shapes. Perform all these operations singly, simultaneously, progressively or in combination. Besides, BORE-MATICS often eliminates other finishing operations. They also can be used for roughing and semi-finishing.

Even if you think you know the BORE-MATIC story—let us bring you up to date on it. You'll find BORE-MATIC performance facts pretty convincing proof that it is the precision answer to faster, better, less costly volume production.

THE HEALD MACHINE COMPANY
WORCESTER 6, MASS.

HEALD

means more precision faster!

INTERNAL AND SURFACE GRINDING MACHINES
BORE-MATIC PRECISION FINISHING MACHINES

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American Machinist

April 12, 1945

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RETURN POSTAGE GUARANTEED

VOLUME 89 — NUMBER 8

AMERICAN MACHINIST. Copyright 1945 by McGraw-Hill Publishing Co., Inc. Published every other Thursday, price 35c a copy. Allow ten days for change of address. Subscription rates—United States, Mexico and Central and South American countries, $5 a year, $8 for two years, $10 for three years. Canada, $6 a year, $10 for two years, $12 for three years. All other countries, $10 a year, $16 for two years, $20 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter, August 13, 1943, at Post Office, New York, N. Y., under the act of March 3, 1879. Printed in U. S. A. Cable address, "McGraw-Hill, New York." Member of A.B.P. Member of A.B.C.

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American Machinist Chips

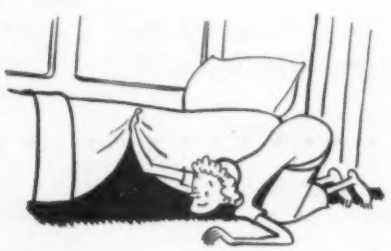
In This Issue . . . Particularly worthy of note in the following pages are:

The lead article on the subject of "Microlapping." It describes how mechanical lapping of journals with coated abrasives produced a surface finish of 1/3 to 1/4 Profilometer reading of ground parts.

Another in the series of "Blue Sections," this one devoted to "Drills." This 12-page feature explains various types of drills, with sketches and tables. Drill standards approved by the American Standards Association are presented.

You may remember the first two installments in this series on "Small Tools." They covered, respectively, milling cutters and single-point tools. Reprints of both, as well as the new section on drills, are available.

Some Ride . . . One of the new sleeping car designs recently shown at a private exhibit by the Pullman-Standard Car Mfg. Co. is called (as reported in the press) the "duplex-roomate." We are tempted to wonder whether this was a typographical error and should have been "duplex-roomette", or whether it truly involves a room mate. Lots of possibilities in the latter.



Coincidence? . . . Last month both Cooper-Bessemer and Worthington announced preliminary details of dual fuel engines . . . diesels capable of burning either gaseous or liquid fuel.

Postwar Planes . . . American Airlines have released an extremely interesting booklet giving the results of a survey among 27,163 air travelers, seeking thoughtful answers to many questions about postwar air transportation.

The variety of features wanted and not wanted in peacetime planes is too great to be covered here. Surprisingly enough, however, 84% said that the size of the plane would make no difference, seeming willing to leave this matter to the experts. The majority don't care whether they use land planes or flying boats for overwater trips and 67% would pay extra for extra speed.

Speaking of planes, North American Aviation Inc. have reported to stockholders that after "carefully considering the possibility of entering other fields of manufacture," it has been decided that "the greatest opportunity for your company's future success lies in the design and manufacture of aircraft products." Interesting news, we suppose, to the makers of refrigerators, automobiles and other products.

How True, How True . . . We are indebted to L. W. Scott Alter, President and General Manager of the American Tool Works Company, Cincinnati, for the following list of rules . . . which has many a true word sprinkled between chuckles. Mr. Alter says he doesn't know who the author is, and he fears George Bernard Shaw would not want to take credit for this bit of whimsy:

CALL THE DEMONSTRATOR
or
TWELVE BASIC RULES ON HOW TO HELP YOUR MACHINE SERVICEMEN
by
Bernard G. Shaw

1. Never send for a service man until everyone has had time to form his own opinion as to how to fix the machine. Have a man from each shift (so none will know what the other fellow has done) work on the machine and leave off all parts weighing over 200 pounds. Dismantle the crane.
2. After sending an "urgent" telegram for the demonstrator to come immediately, put the guard wise so he can make it as tough as possible for him to get in the plant.
3. The minute the demonstrator arrives, ask him where he has been and what has kept him so long. Before he can answer ask him how soon the machine will be operating again.
4. Hide all instruments and blueprints connected with the job he is working on.
5. Always have at least eight engineers present to ask technical questions which are in no way connected with the trouble at hand.

6. Ask him how soon the machine will be operating again.
7. Be sure to give him a helper who has never seen the machine before and also be sure the helper has no tools.
8. The machine should be as dirty and greasy as possible.
9. Ask him how soon the machine will be operating again.
10. Tell the demonstrator what excellent service his competitors give with their machines. (Of course, we realize *their* machines almost never require any repairs.)
11. When he finally gets the machine running, tell him what a swell job he has done, although he should have done it twice as fast.
12. After the demonstrator leaves, write to his company and tell them the machine is worse now than it was before. That will give him a chance to come again and you can go through the above rules all over again.

Vital Subject . . . Among the contributors to *American Machinist's* article in the February 1 issue entitled "Shop Men Give Their Ideas on Improving Machine Tools", was Gosta R. Truedsson, Ph.D., Consulting Engineer of Holden, Mass. He writes us: *"To judge from the letters which I have received in response to my contribution to the subject, it appears that your series of articles is being taken seriously by the men who will be responsible for our postwar machine tool designs."*

Our editors report the same evidences of great interest in this subject.

ALL 4 WHEELS DRIVEN BY SPIRAL BEVEL GEARS

Military trucks . . . with all four wheels driven by Gleason-cut spiral bevel gears . . . are helping to make the cry, "too little, too late," a thing of the past.

Power drive on front as well as rear wheels gives these vehicles the traction to overcome the obstructions of deep mud, steep grades, and rough, shell-torn ground . . . the ability to move men and supplies cross-country directly to the battle front.

In handling the load extremes encountered in this type of transport, the driving gears must take terrific punishment. Because they possess the required accuracy, load capacity, and toughness, Gleason-cut spiral bevels are universally used for the final right-angle drive in these applications.

Today, Gleason machines are engaged in precision manufacture of spiral bevel gears for military trucks and other materiel of war. To-morrow they will be available to bring improved performance to the products of a world at peace.

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

1000 UNIVERSITY AVENUE, ROCHESTER 3, N. Y., U. S. A.

Above: CINCINNATI *3-24 Plain Hydromatic Milling Machine equipped with a special magazine type loading fixture and a gooseneck overarm, milling six spindle bolt locking pins at one time at a rate of 1300 per hour. Notice greatly increased underpass clearance with this type of overarm.*

CINCINNATI

Right: CINCINNATI *4-36 Plain Hydromatic Milling Machine is equipped with an offset overarm to allow the work and fixture to advance to the cutter. Part to be milled may extend well above the top of the machine.*

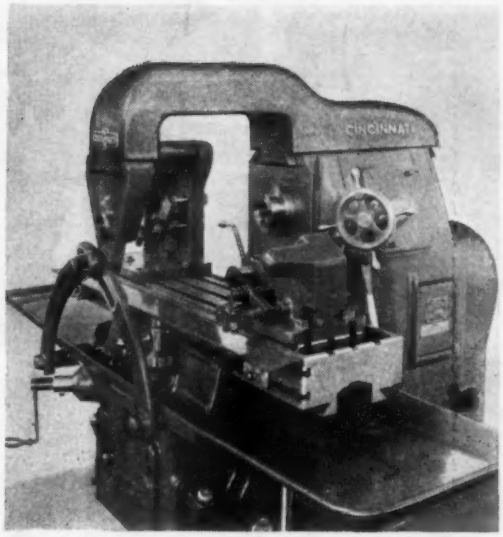
Keep on buying WAR BONDS

THE CINCINNATI M

MILLING MACHINES

UNDERPASS CLEARANCE CAN BE INCREASED with a CINCINNATI OVERARM

A CINCINNATI gooseneck overarm proves a practical way to take care of tall parts which require greater clearance than allowed by the usual type of overarm. And where it is necessary for a tall work piece and fixture to advance to the cutter (without passing under the overarm), the CINCINNATI offset overarm provides a satisfactory solution for this situation. Illustrations on the opposite page show both types. Either overarm can be made to your specifications within any practical limit and for any CINCINNATI horizontal milling machine. They are ruggedly constructed, assure ample strength and rigid support for the bearing-collar end of the arbor. Perhaps this type of equipment may help solve some of your milling problems. Our engineers will be glad to talk over your milling problems with you.



CINCINNATI *No. 1-18 Plain Automatic Milling Machine, equipped with two fixtures for reciprocating cycle, and gooseneck overarm to increase the underpass clearance for the left-hand fixture.*

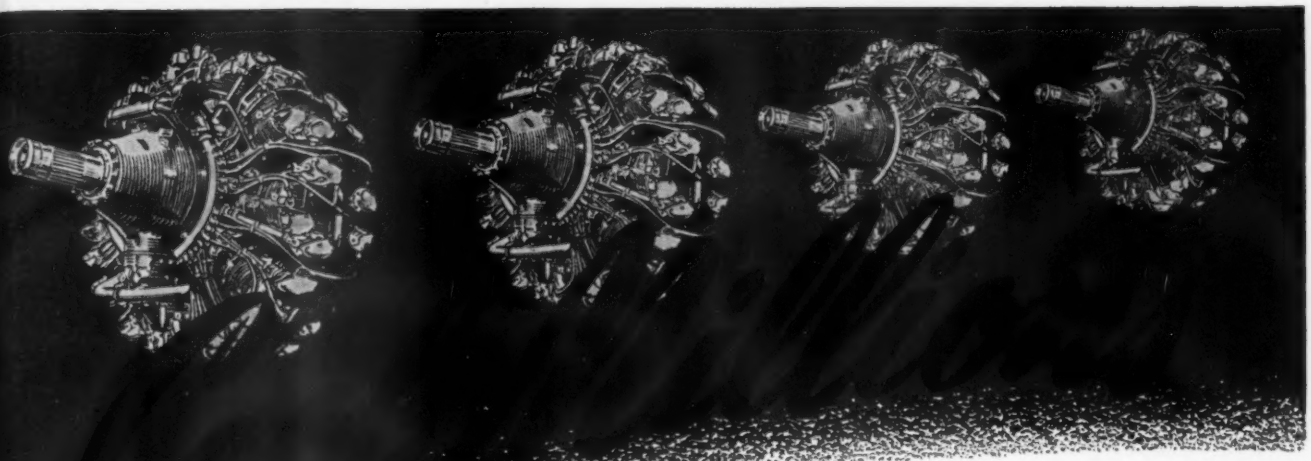
MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A

BROACHING MACHINES • CUTTER SHARPENING MACHINES

Inspecting cylinder finning tools in the Wood-Ridge plant of the Wright Aeronautical Corporation. Photograph courtesy the Wright Aeronautical Corp.

Beyond a SHADOW of a doubt

This book "Beyond a Shadow of a Doubt" will tell you more about our Optical Comparators and what they are doing.



WITH THE HELP OF
JONES & LAMSON *Optical Comparators*

Proper dissipation of millions of heat units from the cylinders of the 2200 H.P. Wright Cyclone 18's that power the B-29 Superfortress, depends upon the perfection of the cylinder fins. To be sure that these fins are accurate —beyond a shadow of a doubt—the tools that cut them from solid metal are inspected on Jones & Lamson Optical Comparators.

Quality control by the inspection of tools, parts and products, with Jones & Lamson Optical Comparators, is an accurate, rapid process. Objects that require hours to inspect by other means can be inspected in minutes, or even seconds.

JONES & LAMSON
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

OPTICAL COMPARATORS

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

BENCH COMPARATOR WITH 14" DIAM. SCREEN & MEASURING ATTACHMENTS

STANDARD BENCH COMPARATOR

BENCH COMPARATOR 14" DIAM. SCREEN

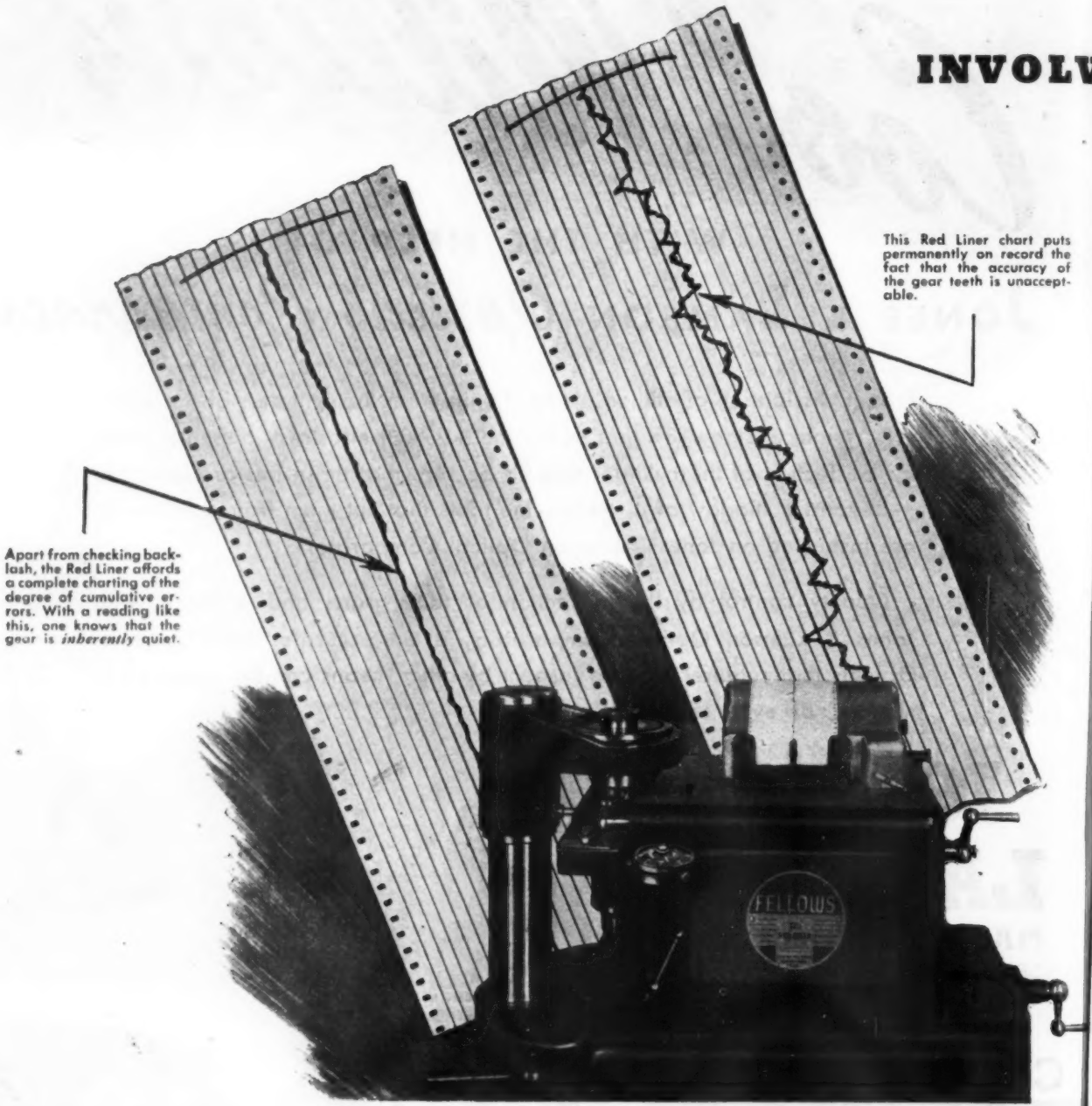
DIRECT PROJECTION COMPARATOR

STANDARD PEDESTAL COMPARATOR

PEDESTAL COMPAPATOR 22" — 30" DIAM. SCREENS

"Red Liner" USEFULNESS . W

INVOLV C



This Red Liner chart puts permanently on record the fact that the accuracy of the gear teeth is unacceptable.

Apart from checking backlash, the Red Liner affords a complete charting of the degree of cumulative errors. With a reading like this, one knows that the gear is *inherently* quiet.

The Red Liner as set up for inspection of internal gears, arranged with Backlash Measuring Device.

THE FELLOWS METHOD . . . MACHINES AND TOOLS F LL

WHEN GEAR INSPECTION

CRITICAL Backlash LIMITS . . .

- ***In final gear inspection*** where a combination check is desired on concentricity, tooth spacing, tooth shape, etc.; the Fellows Red Liner performs these checks in one operation. The cumulative errors are recorded on a paper chart to a magnified scale of 200 to 1, and the character, location and amount of each error can be quickly identified.

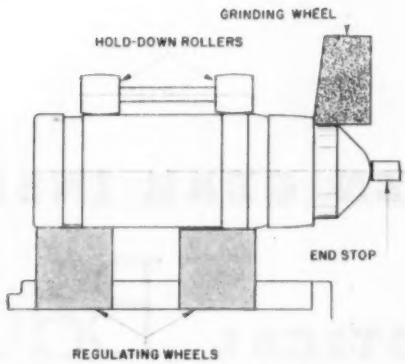
- ***Close-limit backlash inspection*** procedure can be expedited by a new device applied to the standard Red Liner. Once this device has been set to a master work gear, it is possible to read blacklash direct on a special "limit-type" dial indicator.

Developments in gear design and production are moving at a rapid pace Fellows provides a complete line of equipment for handling both manufacturing and inspection operations. When figuring on your post-war requirements, why not consult with us, and in the meantime ask for a copy of our interesting booklet, The Fellows Method. Write: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Bldg., Detroit 2, Michigan, or 640 West Town Office Bldg., Chicago 12, Illinois.

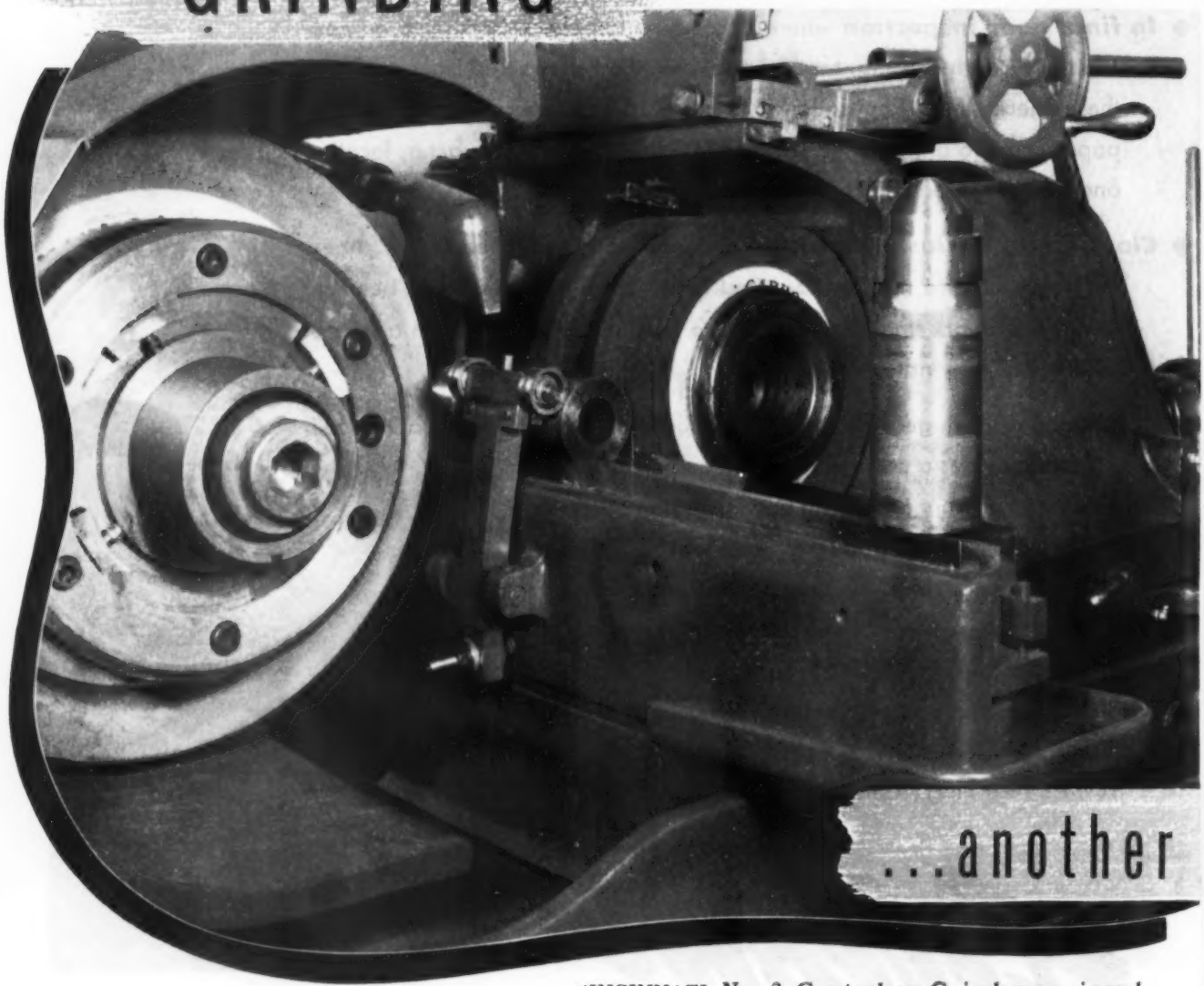
Fellows

ALL OPERATIONS FROM BLANK TO FINISHED GEAR

OFFSET CENTERLESS GRINDING



Simplified sketch shows the offset centerless principle.



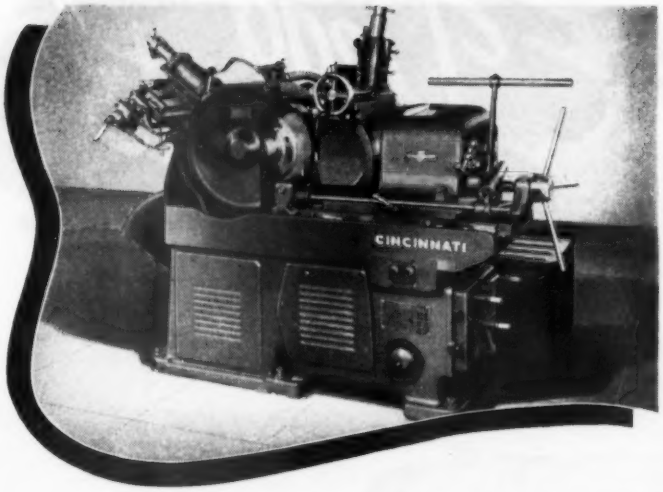
...another

CINCINNATI *No. 2 Centerless Grinder equipped with special work rest for offset grinding 2.398 thread diameter on ordnance part.*

Keep on buying WAR BONDS

CINCINNATI

CENTER TYPE GRINDING MACHINES



CINCINNATI

CINCINNATI *No. 2 Centerless. Complete specifications may be obtained by writing for Catalog G-456-3. A brief description is given in Sweet's Catalog File for Mechanical Industries.*

Offset grinding on a CINCINNATI Centerless means that the grinding and regulating wheels are offset from each other. The grinding wheel grinds a section *at the end of the part* while the greater portion, or entire length of the part, contacts the regulating wheel to assure driving force. And to hold the part in position, spring pressure hold-down rollers press the part against the regulating wheel to maintain contact and increase the driving force. This prevents any tendency of the part to cock between the wheels. ¶ Special equipment depends upon the job, and for the one illustrated on the opposite page it includes: Profile Truing over regulating wheel; two Regulating Wheels; Infeed Work Rest with Spring Loaded Rollers and Work Holding Cradles for receiving one ground piece and holding one unground piece. ¶ Our engineers will be glad to tell you more about offset grinding.

example of Cincinnati Engineering

GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

NO OPERATOR "Dead Spots" IN

No. 36 UNIVERSAL MILLER Table 58" x 13". 18 speeds: 30 to 1500 rpm. 18 feeds: ⅜" to 32". Range: 35" longitudinal, 12" cross, 22¾" vertical.

VAN NORMAN RAM-TYPE UNIVERSAL MILLERS

1 Front and Rear operation of *manual* and *power* feed controls

2 Adjustable cutterhead gives vertical, horizontal and angular milling

3 Movable Ram provides increased work capacity

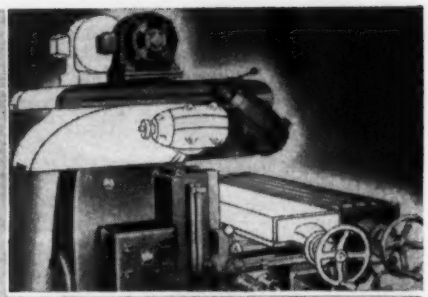
Whether the operator is at the front or rear of the machine, he always has complete control of a job on Van Norman Ram-type Millers. Why? Because all feed controls—manual or power—are located in both the front and rear of the machine. This means that there is no more running from front to back or vice versa to line up work for the cut. It means complete visibility of the cutting operation no matter in what position the operator stands. Result—no back and forth steps . . . minimum worker fatigue . . . and most important, accurate work with minimum rejects.

In addition to "complete control of the situation", Van Norman Universal Millers have an adjustable cutterhead that permits vertical, horizontal or angular milling on one machine, permitting operators to complete most jobs without work reset-ups.

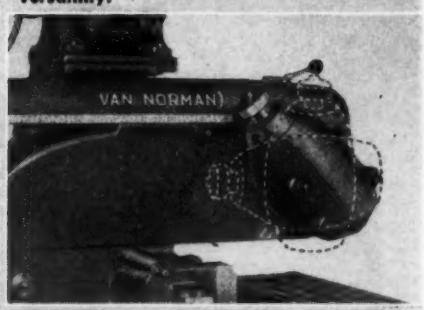
Other Van Norman features such as movable ram, single feed and speed selectors, front and rear directional control of all power feeds, extra heavy-duty construction of ram, column, table and knee assemblies—all assure increased accuracy, simplicity of operation and ease of maintenance. Write for information.

VAN NORMAN COMPANY

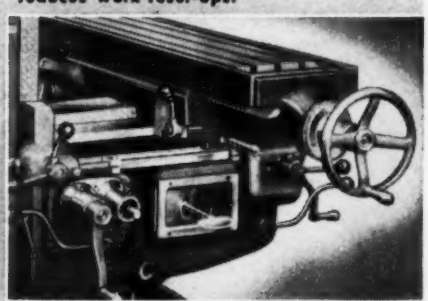
SPRINGFIELD 7, MASSACHUSETTS



Adjustable cutterhead and movable ram in combination with the saddle cross feed provides maximum milling capacity and versatility.



Adjustable cutterhead permits vertical . . . horizontal . . . or angular milling all on one machine—gives you the work range of several types of millers . . . greatly reduces work reset-ups.

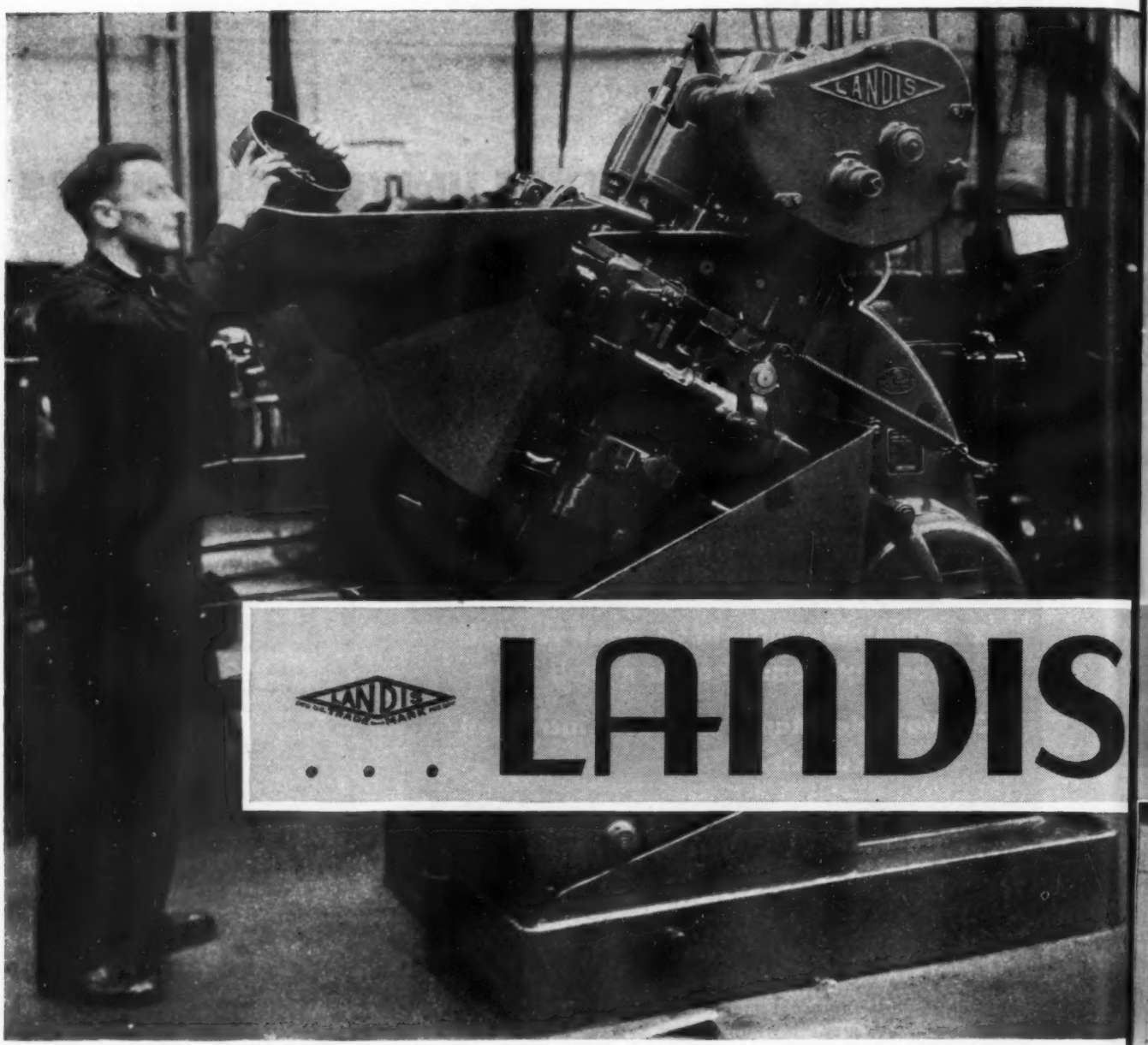


Front and Rear control of both hand and power feeds gives operator complete control of milling operations from either location.

"It pays to Van Normanize"

VAN NORMAN MACHINE TOOL COMPANY

SPRINGFIELD, MASSACHUSETTS



LANDIS

. . .

The Landis Automatic Forming and Threading Machine gives you maximum operating efficiency at low threading cost, since one operator and a helper easily service a battery of six or eight machines.

Results obtained in threading cap screws illustrate the production which may be expected with the Landis Automatic Forming and Threading Machine—threading 7/16 dia. 20 pitch N.F. cap screws made from alloy steel, more than 1000 screws are pointed and threaded per hour with one machine. Threads are held to Class 3 specifications.

For more production, finer accuracy and lower threading cost, use the Landis Automatic Forming and Threading Machine.

Bulletin E-70 will be sent upon request

More Production

Finer Accuracy

WITH THE LANDIS AUTOMATIC FORMING AND THREADING MACHINE

MACHINE CO. WAYNESBORO PENNA. U.S.A.

BIG HOLES

LITTLE HOLES

It makes no difference — there's an "AMERICAN" for every job.

"AMERICAN" Hole Wizard Radials are meeting the challenge of intensive production without a whimper. Day in and day out in the production shops throughout the country they are drilling, boring and tapping at top speed and at the same time maintaining amazing standards of accuracy.

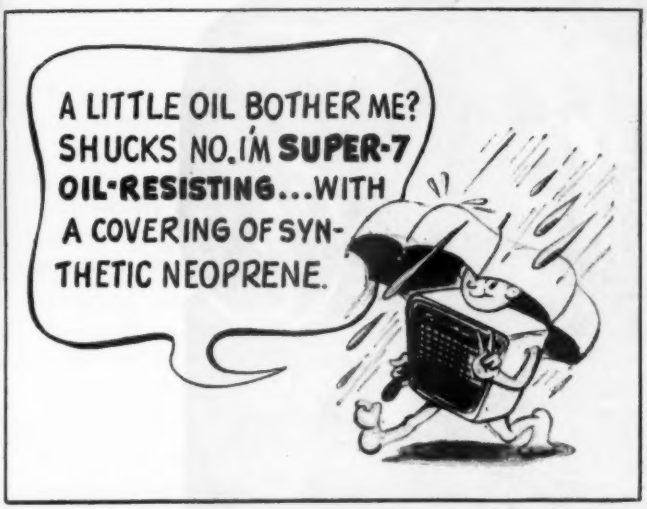
Manufacturing shops that have established enviable records for low cost production are using "AMERICAN" Radials.

THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U. S. A.

Lathes and Radial Drills

I'M SUPER-7-STEEL--NEWEST AND STRONGEST MEMBER OF TEXROPE'S V-BELT FAMILY. EXTRA-HEAVY LOADS. FIXED CENTER DISTANCES ARE WHERE I SHINE.
MEET ALLIS-CHALMERS FAMOUS
V-Belt Family!
To lick each of your different belt problems, you'll be sure of finding the right belt in America's widest V-belt line... Allis-Chalmers' Texrope!



180° F IS JUST COMFORTABLY WARM FOR ME. ASK FOR HEAT-RESISTING SUPER-7 STANDARD BELT WHEN WORRIED ABOUT TEMPERATURE.
♪ Tune in the Boston Symphony, Blue Network, Saturday at 8:30 pm, EWT.

IT PAYS TO MAKE ALLIS-CHALMERS YOUR

V-BELT DRIVE HEADQUARTERS

Texrope Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

Leads in Design To Simplify

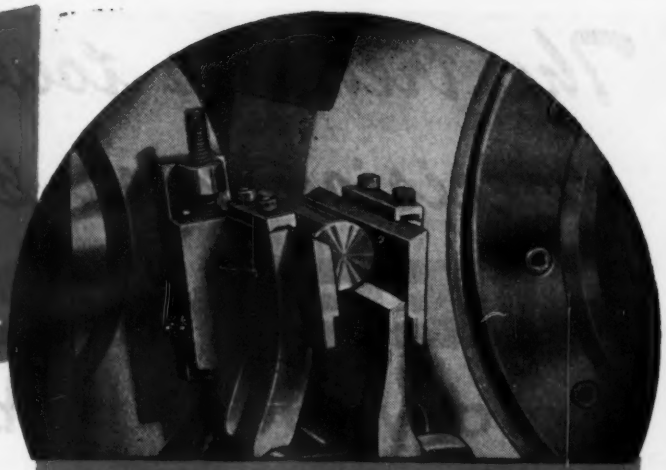
Landis Tool #12 Centerless grinding machine—capacity $\frac{1}{16}$" to 3½" diameter. Thrufeed or infeed operation for round or tapered work.

LANDIS TOOL

Precision Grinders

LANDIS TOOL COMPANY

Centerless GRINDING OPERATIONS



Regulating wheel is dressed by means of the hydraulically operated cross slide which moves the wheel across the diamond rigidly mounted in the work rest. *Wheel is dressed at exact point of contact of work being ground.*

Main control grouping includes master start and stop buttons giving operator constant and instant control. Also three-way selector switch for set-up, grinding, and dressing. Separate adjustments provide regulating wheel speed adjustment and speeds for dressing both wheels.

Regulating wheel base is completely self-contained and powered by a variable speed motor which permits speed adjustments without interruption of grinding cycle. Wheel base can be tilted, swiveled and has a hydraulically operated cross slide.

Correct Functional Design
Saves Operation Time
Speeds Output
Increases Production

"No machine tool is ever good enough if it can be made better" is a working principle always applied to Landis Grinder design and manufacture. As a result, the new Landis #12 Centerless Grinder incorporates every modern improvement and design feature that provides for operational ease, speed and efficiency. Specific advances in its design are:

- Grinding wheel dresser rigidly mounted directly above wheel. Hydraulic control readily accessible from operating position. Ear phone attached to dresser mechanism to determine when diamond is in contact with wheel.
- Regulating wheel base and hydraulic cross slide mounted on swivel for grinding taper work. Eliminates need for taper dressing of wheel which causes excessive wheel loss.
- One shot lubrication supplies oil to guide surfaces, feed screw and nut of wheel bases eliminating need for numerous grease gun fittings and oil cups.
- Grinding wheel base adjustable toward or away from work to compensate for wheel wear and varying diameter
- Convenient three-way valve controls coolant to diamond when dressing, to work when grinding or cuts off flow entirely.

For complete information on the features of the new Landis Tool #12 Centerless grinding machine, write for catalog T44. 19

LANDIS TOOL Company

IY WAYNESBORO, PENNA.

The trend is toward large scale precision gear production with

LEES-BRADNER

Rotary Gear Hobbing Machines

In the highly competitive markets of tomorrow, precision gears in great quantities at low cost will be essential to meet the new conditions that are now anticipated.

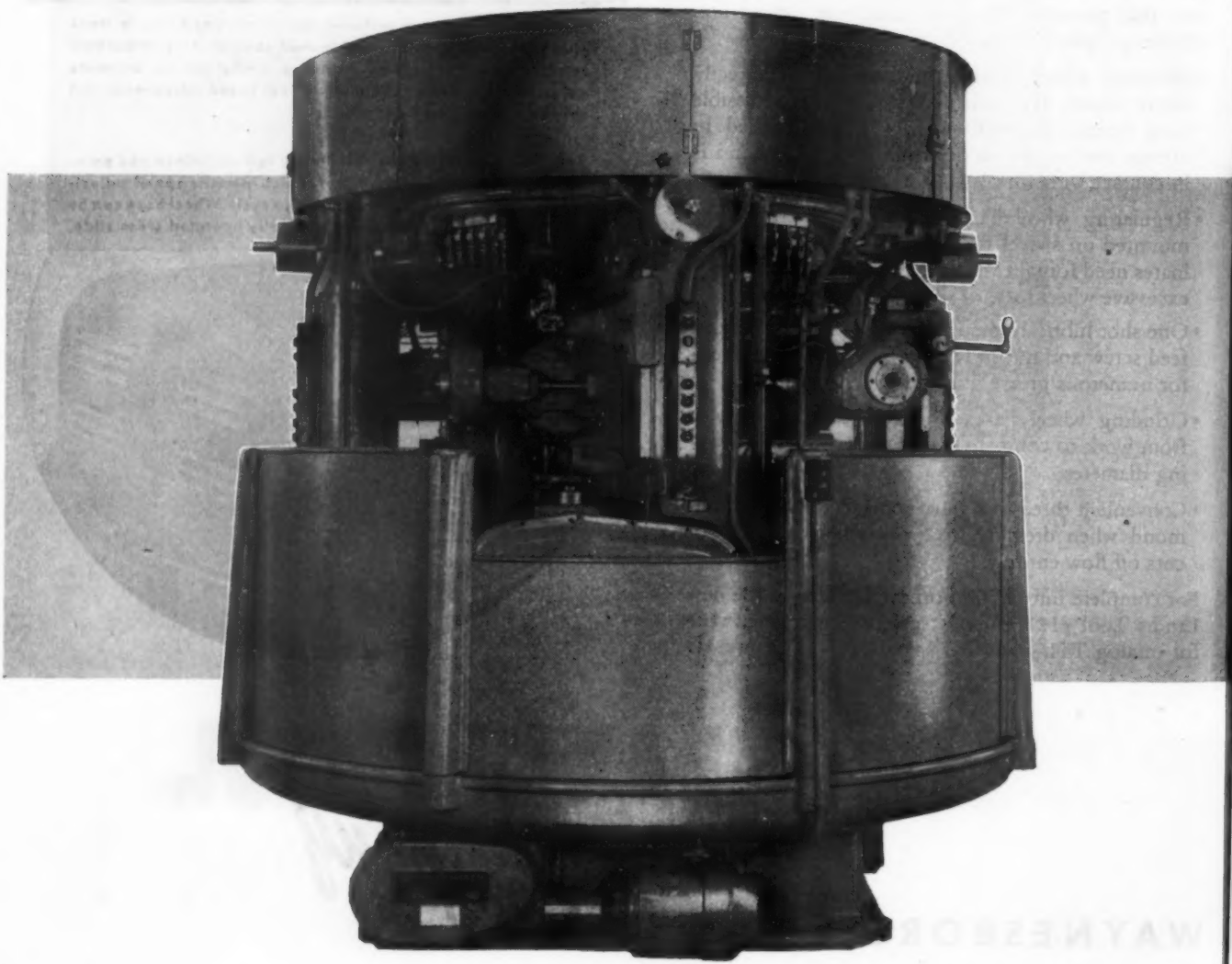
Even before the War, Lees-Bradner Rotary Gear Hobbing Machines were used extensively on high production gear generation by many leading automotive plants.

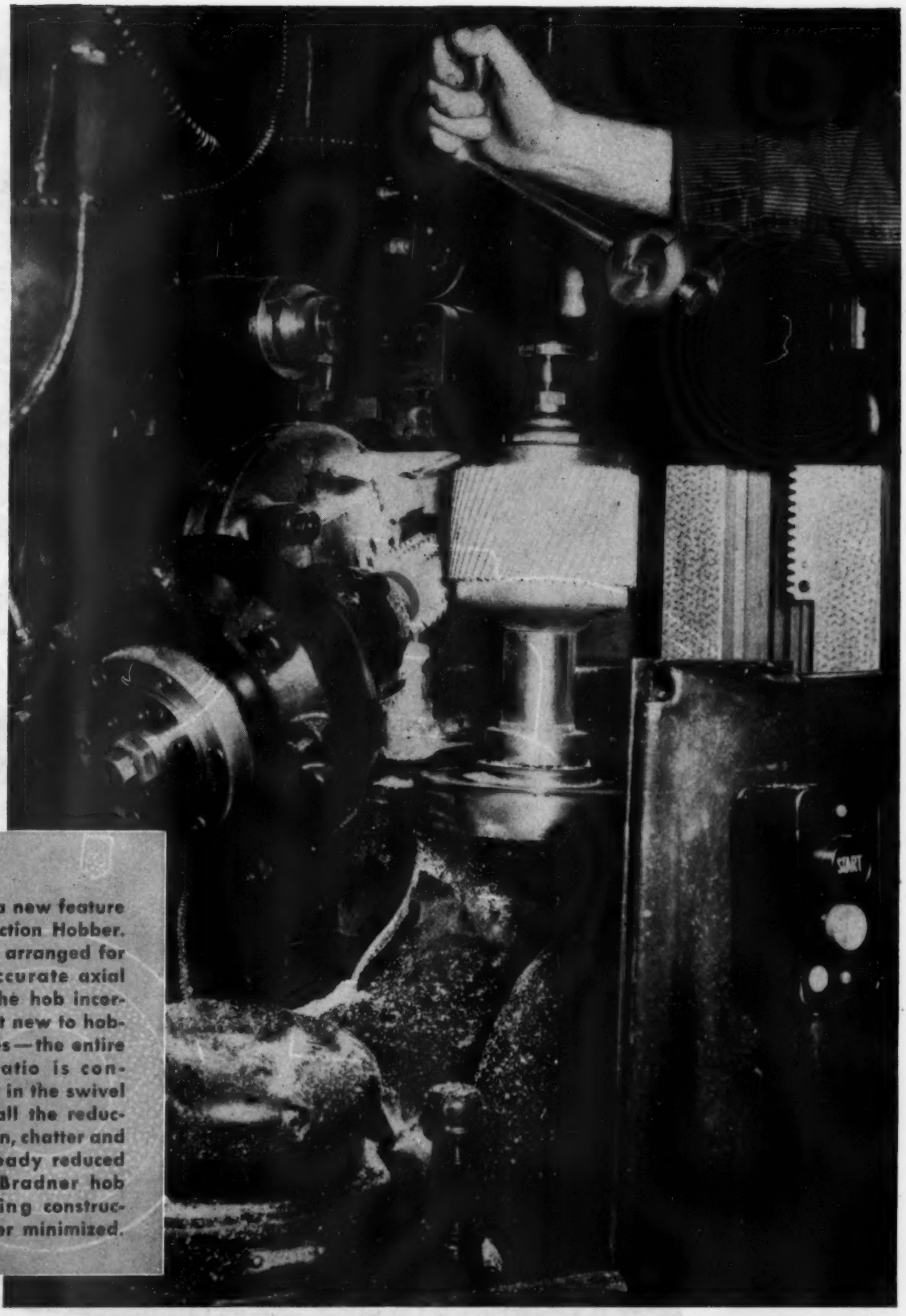
As we approach this new period, manufacturers requiring generated spur and helical gears—*sprockets* and *splines* of dependable accuracy and uniformity will find the Lees-Bradner Rotary Gear Hobbing Machines the answer to precision gears, in quantity at low cost.

The operation of the machine is very simple and does not require particularly skilled help. The operator has only to load the machine and press a button the rest of the tool's functions being performed by the machine itself.

The machine is exceptionally versatile both in operation and as to work handled. The same job may be machined on each spindle or a different job may be handled on each spindle for climb or conventional hobbing.

Consult Lees-Bradner on your precision gear generation.



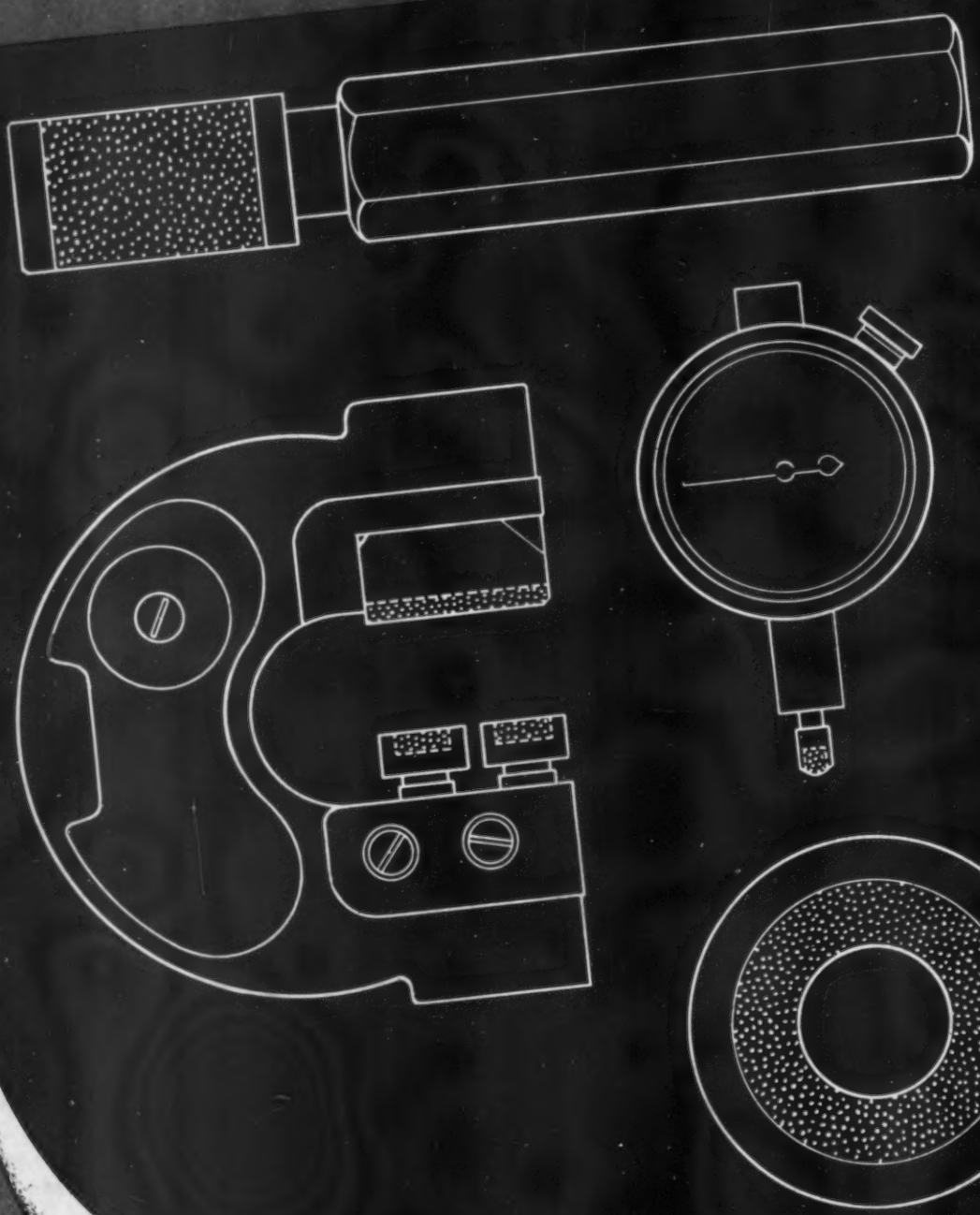


Illustrated is a new feature of the Production Hobber. The Hobhead arranged for quick and accurate axial shifting of the hob incorporates a unit new to hobbing machines—the entire back gear ratio is contained wholly in the swivel head. Since all the reduction is so taken, chatter and backlash already reduced by the Lees-Bradner hob spindle bearing construction, is further minimized.

The LEES-BRADNER Company

CLEVELAND, OHIO, U.S.A.

Blueprint for PROGRESS



NORBIDE — The Hardest

REGISTERED TRADE MARK

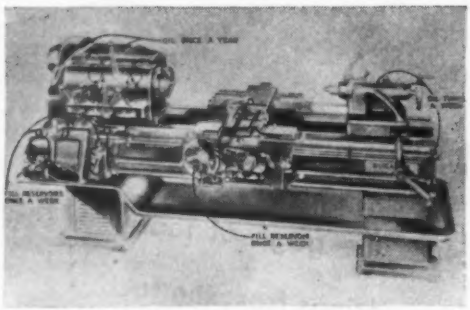
NORBIDE Gages

Progressive shops have quickly realized that the gage of today (and the future) is NORBIDE. This preference springs from the fact that NORBIDE Gages are outwearing conventional types of measuring devices 100 times and more. Made of Norton Boron Carbide —"the hardest material made by man"—NORBIDE Gages show exceptional resistance to abrasion and scratching, will not pick up lint nor become charged with particles of metal, are inert to chemicals employed where gages are used. Due to its homogeneity NORBIDE becomes smoother with use.

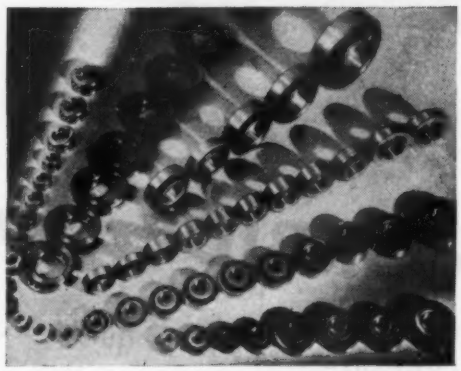
Ask your regular gage supplier about NORBIDE—or for additional information write to:

NORTON COMPANY • **WORCESTER 6, MASS.**

Material Made By Man

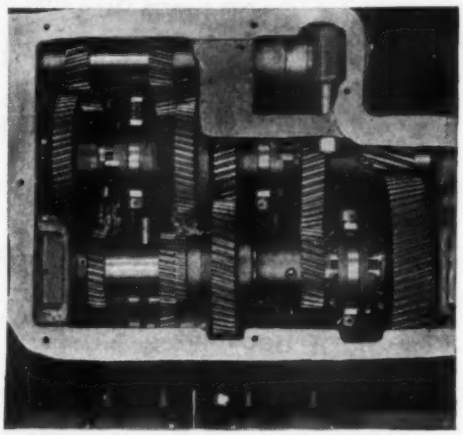


Automatic force-feed lubrication: requires minimum amount of attention from maintenance men or operators. Permits operation at higher speeds without danger to working parts and allows full utilization of the power and rigidity of Monarch lathes.

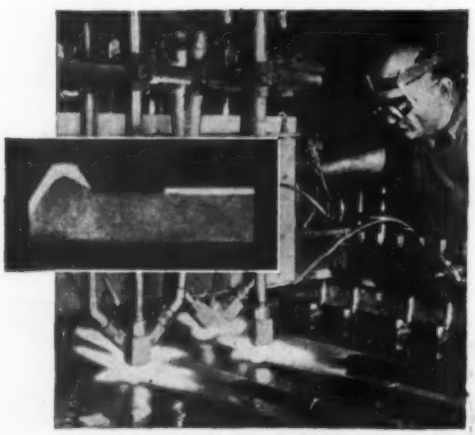


Anti-friction bearings: Monarch headstock spindles turn on anti-friction bearings, thus reducing noise and wear and assuring long-time accuracy in performance. Anti-friction bearings were introduced by Monarch in 1927, and are used on all vital bearing surfaces.

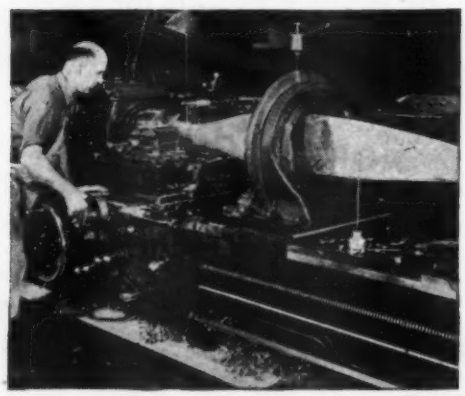
These Features keep *Monarch Lathes* on the Job



Helical gears: another pioneering development by Monarch in 1924. By providing smoother, quieter operation, without lost motion or backlash between jaw clutches, they lessen wear and vibration throughout all parts of the lathe —an important contribution to longer life.



Flame-hardened bedways: this 1937 Monarch development which helps keep Monarch lathes working with uninterrupted accuracy, has been proved on more than 18,000 Monarch lathes in wartime as well as peacetime production.



Monarch in war production: example of difficult jobs being done on Monarchs is the machining of the hub end of a propeller blade with 13 tools, which complete the job in one setup. Versatility like this keeps Monarch lathes working when other lathes may be idle.

Monarch Model BB 18" Lathe: one of ten sizes of Monarch standard production lathes, ranging from 12" to 36". These, plus six sizes in toolmaker's lathes, and a variety of lathes for special operations, make Monarch the most comprehensive line of high-quality lathes available to industry.

You pay full time for lathe "Vacations"

Whether your machine tools are working or idle, your investment charges continue. Whenever they take enforced "vacations" for repairs or maintenance, you lose money. Costs go up, production comes down—and you can't regain that lost time.

So, when you are considering turning machines, be sure to include Monarchs. They're built to last. They never faltered, even under the toughest schedules on the war production program. They'll turn your work faster, more accurately, and keep on doing it.

And, because they're so adaptable, you can use them for a wide variety of work that you may not have thought could be done on a lathe. Monarchs work when less versatile lathes may be idle.

Let a Monarch engineer show you what Monarchs can do—why they are so sturdy, so dependable and take so few "vacations". He'll show you how they cut costs, give you better, faster production, and how they help give American workers, your customers, the chance to earn more, buy more, have more.

THE MONARCH MACHINE TOOL COMPANY · SIDNEY, OHIO

DIRECT FACTORY BRANCHES

CHICAGO 6, ILLINOIS
622 W. Washington Blvd.
Phone: Randolph 4295

CLEVELAND 6, OHIO
Room 209 Upper Carnegie Bldg.
10465 Carnegie Avenue
Phone: Garfield 2590

DETROIT 2, MICHIGAN
801 Fisher Building
Phone: Trinity 1-0426

INDIANAPOLIS, INDIANA
Maco Building
38 and College Avenue
Phone: Wabash 2650

NEWARK 2, NEW JERSEY
635 Industrial Office Bldg.
Phone: Mitchell 2-1770

PITTSBURGH 22, PENNSYLVANIA
512 Empire Building
Liberty Ave. and Stanwix St.
Phone: Atlantic 6428

Representatives in Principal Cities

Monarch Saves Time

because they can be depended on for
ECONOMY, EFFICIENCY *and* SPEED

All the essential performance qualities demanded in small tools today are met in UNION TOOLS.

Faster cutting, longer life between grinds, accuracy and all-round better performance of these tools are matters of common recognition in plants busy on war work where small tools are subjected to the most exacting service conditions.

You, too, can depend on UNION TOOLS for your requirements. Try them once and you'll use them regularly.

THE UNION LINE

Twist Drills — Milling Cutters — Reamers — Hobs — Slitting Saws — End Mills — Taps — Dies — Screw Plates — Profile Cutters.

●

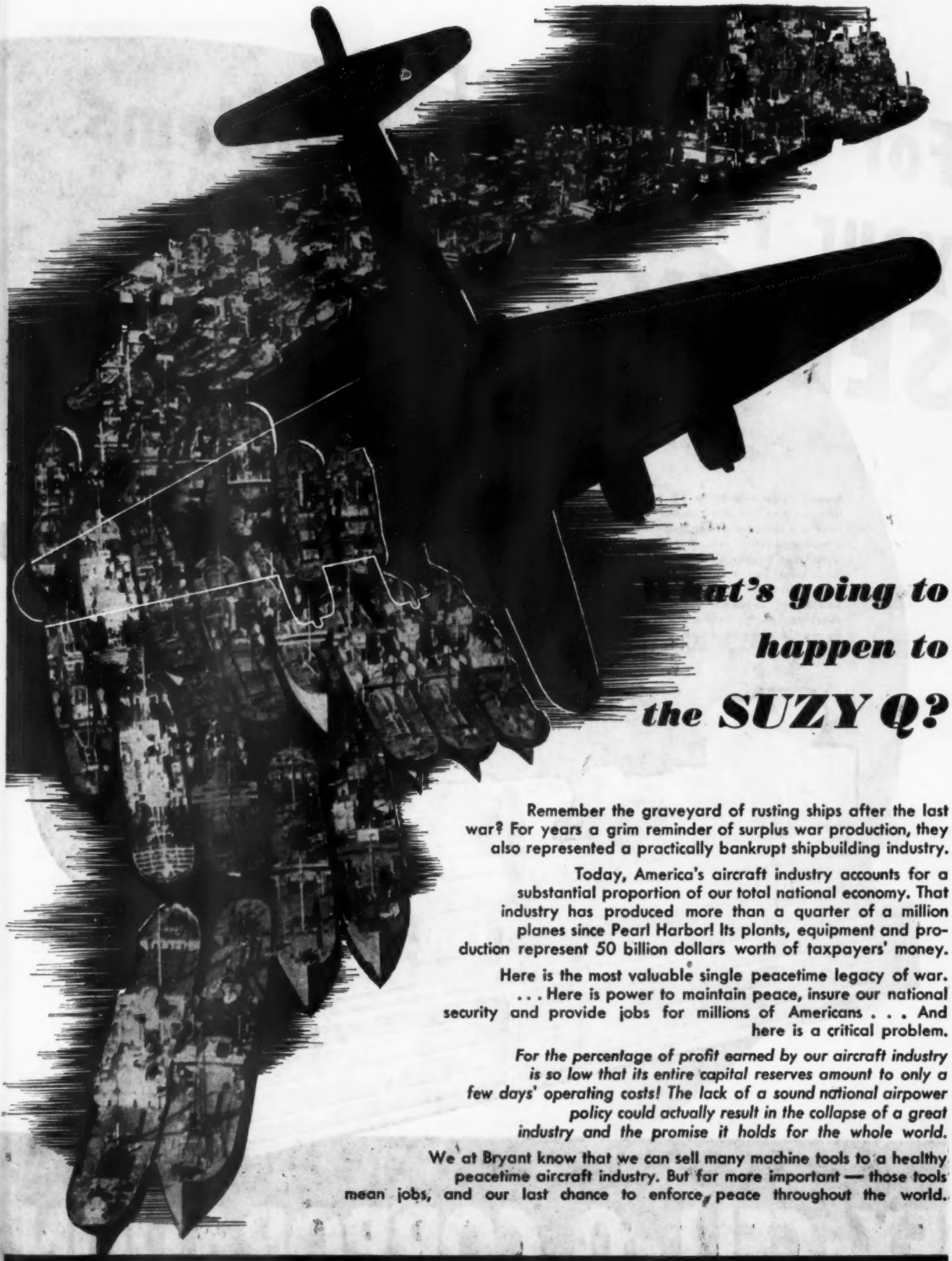
UNION TWIST DRILL COMPANY, ATHOL, MASS.

STORES—New York: 61 Reade St., Chicago: 11 So. Clinton St., Detroit: 5527 Woodward Ave., San Francisco: 121 Second St., Los Angeles: 524 E. Fourth St., Seattle: 568 First Ave., South.

MANUFACTURING DIVISIONS

S. W. Card Mfg. Co. Div., Mansfield, Mass.
Butterfield Div., Derby Line, Vt.
Butterfield Div., Rock Island, Quebec.

UNION



...at's going to happen to the SUZY Q?

Remember the graveyard of rusting ships after the last war? For years a grim reminder of surplus war production, they also represented a practically bankrupt shipbuilding industry.

Today, America's aircraft industry accounts for a substantial proportion of our total national economy. That industry has produced more than a quarter of a million planes since Pearl Harbor! Its plants, equipment and production represent 50 billion dollars worth of taxpayers' money.

Here is the most valuable single peacetime legacy of war. . . . Here is power to maintain peace, insure our national security and provide jobs for millions of Americans . . . And here is a critical problem.

For the percentage of profit earned by our aircraft industry is so low that its entire capital reserves amount to only a few days' operating costs! The lack of a sound national airpower policy could actually result in the collapse of a great industry and the promise it holds for the whole world.

We at Bryant know that we can sell many machine tools to a healthy peacetime aircraft industry. But far more important — those tools mean jobs, and our last chance to enforce peace throughout the world.

BRYANT GRINDER COMPANY SPRINGFIELD VERMONT, U.S.A.

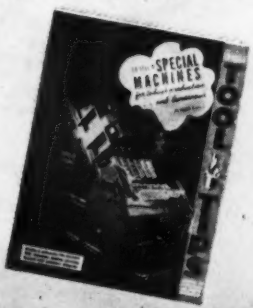
For the answer to your Production
SEE

The Ex-Cell-O hydraulic control panel is illustrated at left. All valves that operate the table, with its two adjustable feeds in both directions, are in this conveniently located panel. The knob reverses table travel manually if required. Otherwise the reversal is an automatic one.

At Ex-Cell-O you will find a substantial background of experience in the precision machining of metal parts on a production basis

TO MAKE sure of low "unit cost" on high production jobs you're planning for *tomorrow*, you should get in touch with Ex-Cell-O *today*. For many years Ex-Cell-O has been foremost in the designing and construction of special multi-purpose and semi-standard machines for America's leading industries, both small and large. A quarter of a century of *precision engineering* has gone into Ex-Cell-O experience. This "know how" has made the Ex-Cell-O name well and favorably known throughout the industrial world. The advantages of this practical background are available to you *now*, when the pressure of post-war competition is fast approaching. In your production plans, give early consideration to Ex-Cell-O multi-purpose machines. They frequently perform numerous operations in one set-up, often substantially increase the number of parts hourly produced, with improved quality and lower unit cost.

Right: If you do not now receive Ex-Cell-O TOOL TIPS, devoted to precision and speed in production, send your name, company, address and position to Ex-Cell-O Corporation, 1200 Oakman Boulevard, Detroit 6, Michigan.



45-45

XLO

EX-CELL-O *for* PRECISION

Standard and Special Multiple Way-Type Precision Boring Machines

•

Multiple Drilling and Other Special Purpose Machines

•

Precision Thread Grinding Machines

•

Precision Lapping Machines

•

Broaches and Broach Sharpening Machines

•

Continental Cutting Tools

•

Tool Grinders

•

Hydraulic Power Units

•

Grinding Spindles

•

Drill Jig Bushings

•

Fuel Injection Equipment

•

R. R. Pins and Bushings

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Pure-Pak Paper Milk Bottle Machines

•

Aircraft and Miscellaneous Production Parts

DETROIT 6, MICHIGAN

CUTTING NEW HIGH-SPEED FIGURES

PRODUCERS AND MANUFACTURERS

Bigger production

ARMY NAVY

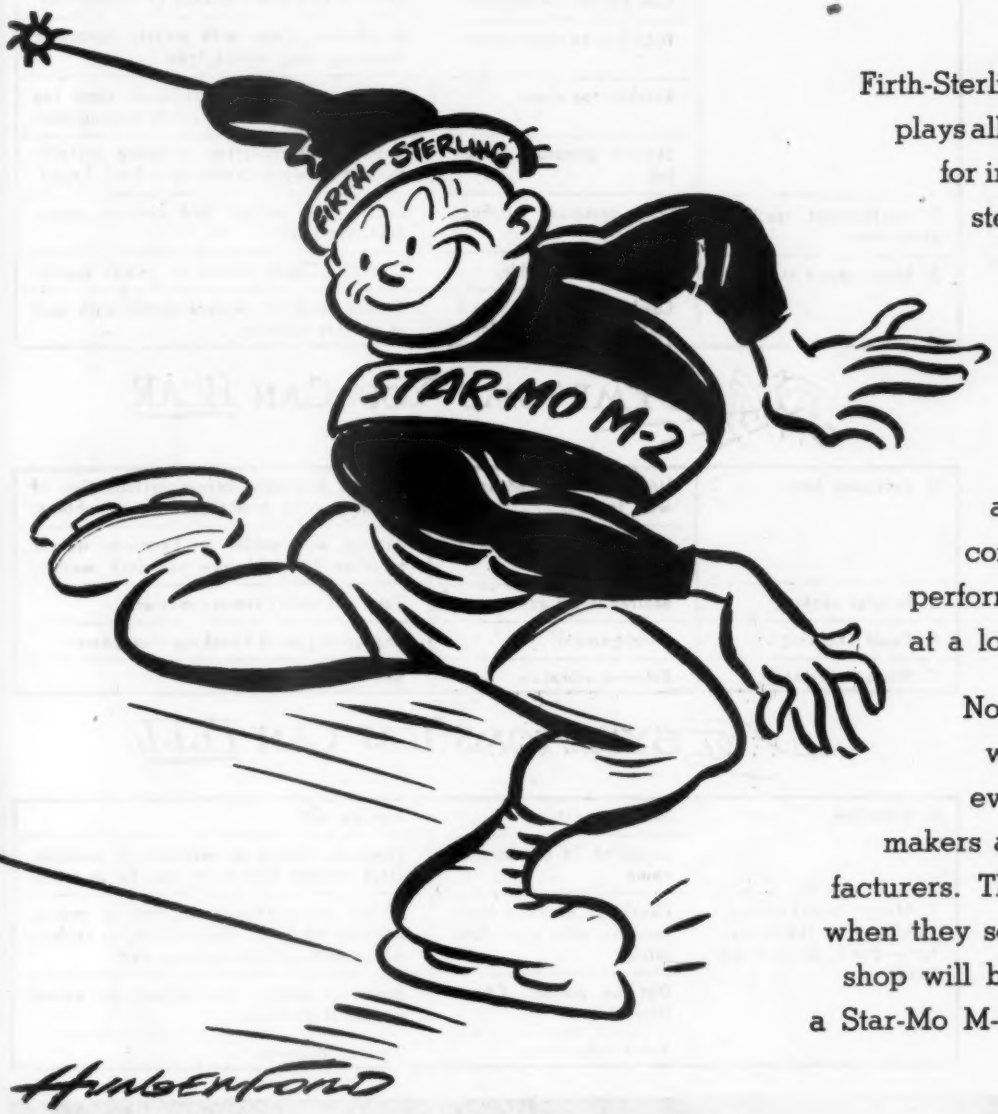
Firth-Sterling
STEEL COMPANY

MAKERS OF HIGH-SPEED STEELS, TOOL AND DIE STEELS, AND SINTERED CARBIDES

STAR-MO M-2

Improved

TUNGSTEN-"MOLY" HIGH-SPEED STEEL



Firth-Sterling's Star-Mo M-2 displays all the advantages looked for in a modern high-speed steel for general use.

It out-classes the old traditional 18-4-1 steels in all important points: it outcuts and out-lasts, assuring bigger, more consistent production; it performs with ease. All this at a lower cost.

No wonder Star-Mo M-2 wins the acclaim of an ever-growing list of tool makers and automotive manufacturers. They know a head-liner when they see one perform. Your shop will be convinced too with a Star-Mo M-2 workout.

Better
Outcuts and outlasts 18-4-1

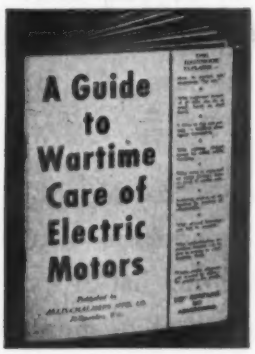
Costs Less
approximately 20% less

Easy to Handle
Ask our Representative

FIRST AID FOR MOTORS

MOTORS RUN A FEVER? No wonder if they do more often today. They're working *3 and 4 times* as many hours as in peace!

Wartime conditions demand you diagnose motor ailments *quickly* . . . remedy the trouble at once. At right are but few of the many diagnoses found in Allis-Chalmers' new "Guide to Wartime Care of Electric Motors". In maintenance as in war, *attack is the best defense.* This book singles out the 9 main enemies of electric motors . . . tells you how to get them *before* they get your motors!



Over 100,000 copies already in use.

Write today for your *free* copy. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WIS.

SYMPTOMS YOU CAN SEE

Symptom	Possible Causes	Cure
1. Excessive sparking or flashing at brushes. Blackened commutator.	Rough commutator.	Sand or turn down, depending upon depth of surface roughness.
	Low bar on commutator.	Grind or turn down balance of commutator.
	High bar on commutator.	If extreme, lower with mallet, tightening clamping ring. Grind true.
	Brushes too short.	Replace with harder grade—if worn too soon . . . and not by rough commutator.
	Shorted armature winding.	Test for short—after removing metallic contact between commutator bars. Repair.
2. Intermittent sparking at brushes.	Open armature winding.	Locate and replace bad coil—or repair defective joint.
3. Motor won't start.	Usually line trouble.	Correct. Check source of power supply.
	Load too heavy. See if motor runs without load.	Reduce load—or replace motor with unit of greater capacity.

SYMPTOMS YOU CAN HEAR

4. Excessive hum.	Uneven air gap. Measure with feelers.	Replace bearings—before introduction of scraping noise indicates rotor is rubbing.
	Unbalanced rotor. Check on parallel bars.	Balance with solder on band—or weight attached by cap screw and lock washer.
5. Regular clicking.	Matter in air gap.	Take out rotor; remove matter.
6. Rapid knocking	Misalignment.	Realign set until knocking disappears.
7. Brush "chatter."	Extreme vibration.	See item 10, below.

SYMPTOMS YOU CAN FEEL

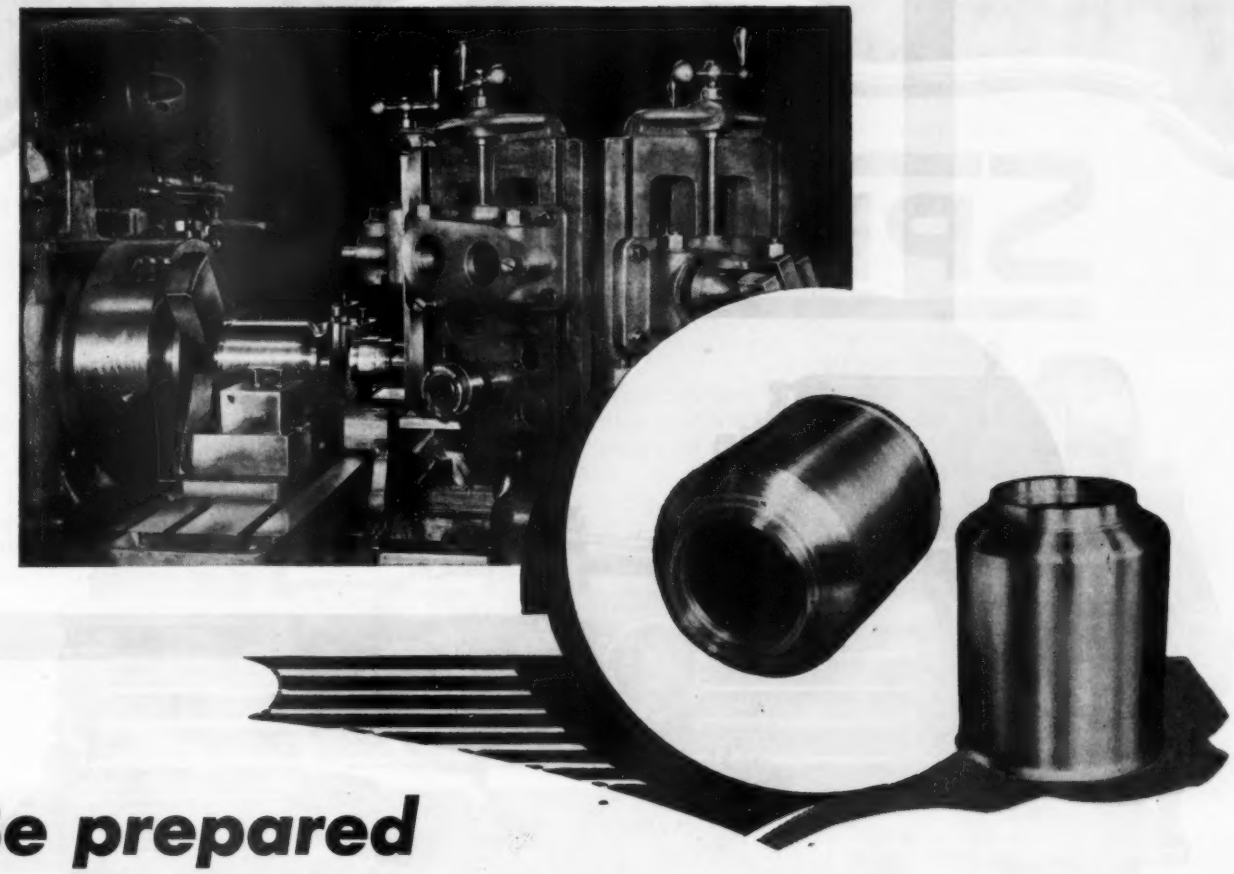
8. Vibration.	Misalignment.	Realign set.
	Vibration in driven machine.	Eliminate source in machine, if possible. Or a flexible belt drive may be in order.
9. Motor overheating. (Check with thermometer—don't depend on hand).	Overload. Measure load; compare with nameplate rating.	Check for excessive friction in motor, drive or machine. Reduce load, or replace motor with greater capacity unit.
	Dirt in motor. Check flow of air.	Blow out motor. Use solvent on wound section if necessary.
	Rotor rubs stator.	Replace bearings.

A 1638

ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.

A-C WE WORK FOR VICTORY WE PLAN FOR PEACE



Be prepared for Peace... BY RE-TOOLING YOUR P & J AUTOMATICS—NOW!

YOU SPECIFY THE PART — P & J WILL DESIGN THE SET-UP

You can keep your present P & J machines right on the job when peace comes and get many more years of useful, profitable service from them by having them changed over for other work.

Shown here is a P & J Type 5DLX Automatic Chucking and Turning Machine handling fast, accurate machining operations on cylinders. The tooling for this job can be readily changed over for low cost production of other parts without sacrificing the speed, convenience and record-making productive performance inherent in all P & J equipment.

P & J Re-tooling offers users of P & J equipment the means of making the changeover quickly so that machines will be back on the production line in shortest possible time. It will be to your advantage to consult our engineers immediately on your reconversion problems.

THE POTTER & JOHNSTON MACHINE CO.
Pawtucket, R. I.

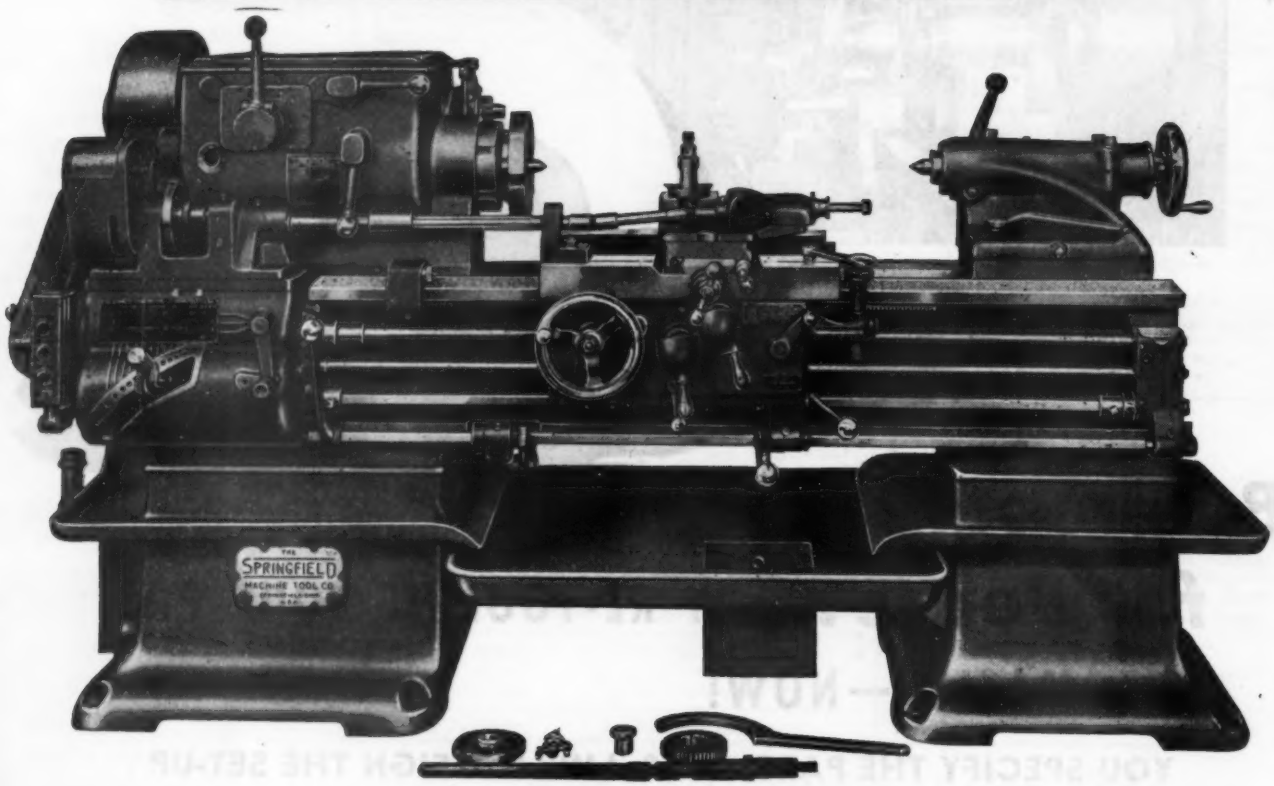
A BOND is a good buy for you and a "GOOD-BYE" to tyrants

P & J Rebuilding Service

P & J offers complete facilities for thoroughly rebuilding customers' P & J Automatics in our shop and restoring them to original productivity and accuracy. Re-tooling can also be handled at the same time.

Choose

SPRINGFIELD



GEARED HEAD LATHES

From the ground up, a SPRINGFIELD Lathe represents superior construction and design. All heavy castings, including the bed, are cast in our own shop . . . gearing is designed for maximum efficiency . . . attachments demonstrate unusual engineering ingenuity . . . lubricating systems and power transmission are built to take it, 24 hours a day. In fact, to fully understand what SPRINGFIELD can do for you, check their superior metal turning records in other shops . . . and judge for yourself.

Under current emergency conditions make it SPRINGFIELD Geared Head Lathe . . . they'll do your job better, now and later, too! Sizes range from 14" to 30". Write concerning deliveries, prices, etc.

The SPRINGFIELD MACHINE TOOL Co.

SPRINGFIELD OHIO U.S.A.

The CONE AUTOMATIC MACHINE COMPANY sees many GOOD THINGS AHEAD

It is reported that . . . . . .

New ideas in highway busses include: separate engines for each driving wheel, hydraulic transmission, increased use of aluminum, 50 passenger capacity, two decks, wider treads and steam power. *Business Week.*

get ready with CONE for tomorrow

A new process deposits a ceramic insulating covering on electric wire. *Sprague Electric Co., N. Adams, Mass.*

get ready with CONE for tomorrow

A new storm-proof wire for rural electrification is made of steel wire covered with copper. *American Steel & Wire Company.*

get ready with CONE for tomorrow

About 10% will be added to the country's cold storage capacity if plans to use a 12 million cubic foot limestone mine for that purpose are successful. *Food Industries.*

get ready with CONE for tomorrow

"Molecular distillation" is now out of the laboratory stage and promises to do such incredible jobs as to separate fish oil from its smell. *McGraw-Hill Overseas Digest.*

get ready with CONE for tomorrow

A hardware wholesaler carrying 50,000 items plans to set up a chain of "cafeteria style" hardware stores after the war. *George Worthington Co., Cleveland.*

get ready with CONE for tomorrow

Claims for the new home heater developed by the Bituminous Coal Institute include: one-third reduction in fuel use, 50 hours of heat in one stoking, cost under $100. To parallel this development, Anthracite Industries Inc. has a furnace 2 x 3 x 3 feet that weighs only 75 pounds. It consists of a tube with the coal entering at one end and ashes forced out at the other. *Coal Age.*

get ready with CONE for tomorrow

A new surgical lamp projects a cone of ultraviolet radiation, through which germs cannot pass, around the wound. *Hanover Chemical & Mfg. Co.*

One of the large oil companies announces a motor lubricant claimed to be unaffected by temperatures from 100 below to 200 above zero. *Cities Service Oil Co.*

get ready with CONE for tomorrow

A new stirring device is driven by an extended motor that revolves the internal rotor by magnetic attraction. *Ohmite News.*

get ready with CONE for tomorrow

A large trucking company, operating in eleven states, plans to add air freight service as soon as planes are available. *All States Freight Inc.*

get ready with CONE for tomorrow

A chemical company has produced a solution which, it claims, will prevent runs in stockings and may be applied with a sponge. *Monsanto Chemical Co.*

A flashlight, in which battery, bulb, and lens are cast in a cylinder of wax, is said to be cheap enough to throw away when its batteries are exhausted. *Geyaun Manufacturing Co., Charlestown, Mass.*

get ready with CONE for tomorrow

The electron micro-analyzer reports on the atomic composition of particles too small to be seen by microscopes. By its use the point of a common pin can be made to look as vast and rough as a mountain range. *Optical Society of America.*

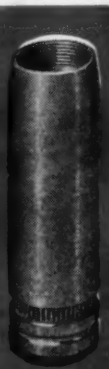
get ready with CONE for tomorrow

In war planes the present type of engine is twice as efficient as jet propulsion at 150 miles per hour; the two are equal at 300 miles; and at 550, jet propulsion is twice as efficient. *EMPIC No. 7.*

get ready with CONE for tomorrow

Steam busses, now being designed, appear to have many advantages, including smooth operation, no idling, no fumes, low operating cost, engine braking, and longer service between overhauls. *Bus Transportation.*

Automatic Production at automatic-cannon speed



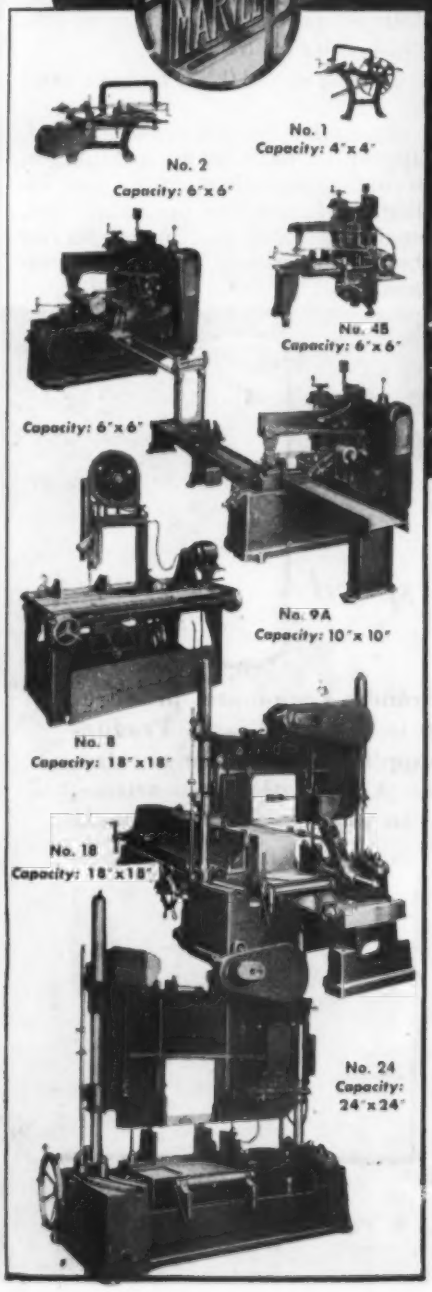
The 1⅝" 8-Spindle Conomatic produces these 20mm. tracer bullets in 8 seconds each. Production like this keeps shell supplies ahead of the requirements of rapid firing guns. Conomatics, in wartime, are a military necessity — in peacetime, an economic necessity.

CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

16

MARVEL SAWS



Steel Warehousing Company, Chicago, features Prompt delivery . . . .

Pieces or lengths cut from bars, tubes or structural shapes can be delivered promptly by this steel warehouse, because they have the MARVEL Saws to handle any cut-off job. Three No. 9A MARVEL Automatic Bar Feed Saws (capacity 10" x 10") which automatically feed, measure and cut-off identical lengths or slices (as gear blanks) from single or nested bars at terrific speed. The fastest hack saws built—these automatic saws require no more operator attention than an automatic screw machine. They are extremely accurate, too, and can be stopped any time in a quantity run, a miscellaneous cut made, and automatic operation resumed by simply re-engaging the bar push-up.

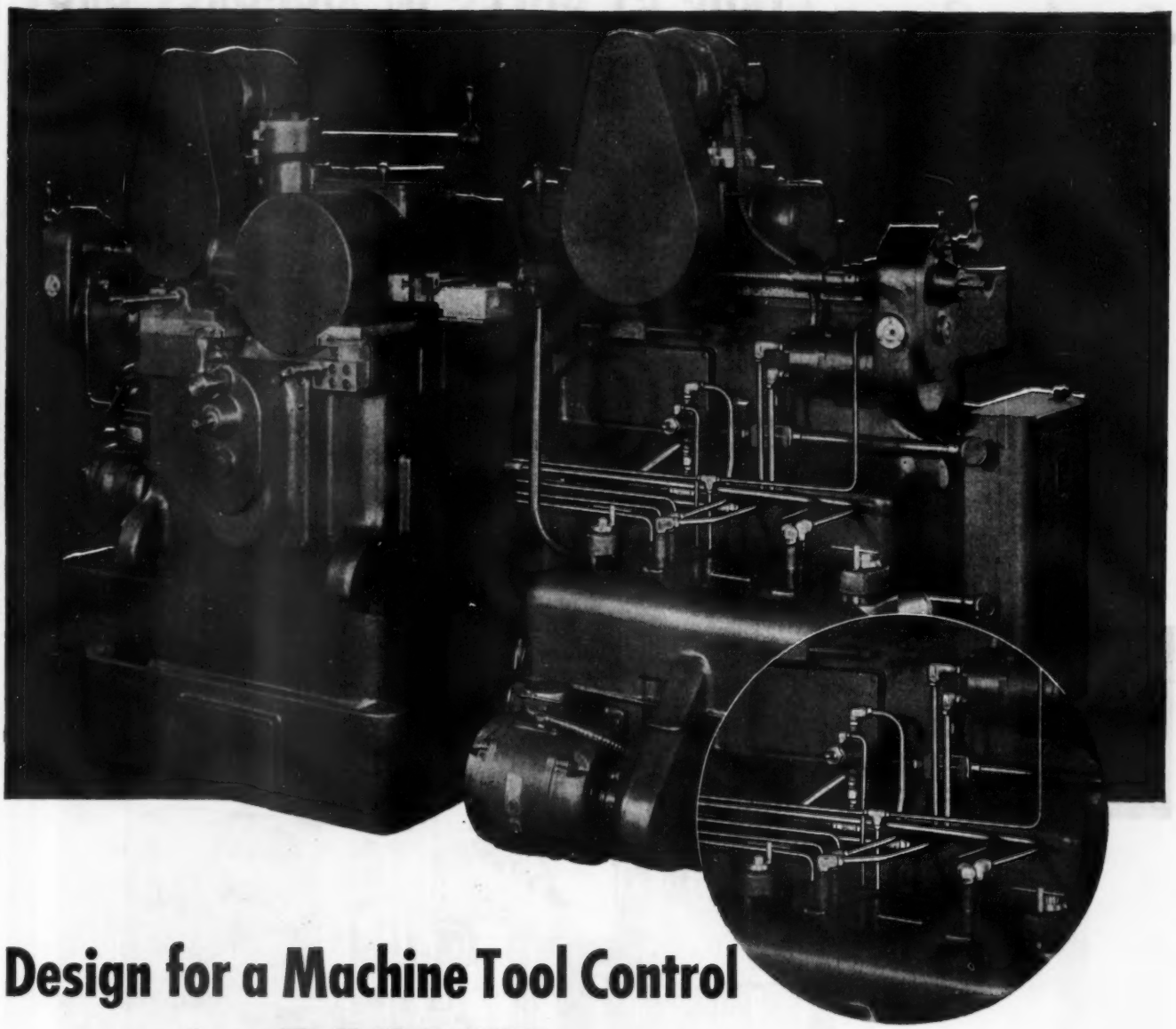
Structural shapes up to 18" and large bars of equal diameters are saw-cut on the No. 18 MARVEL universal Roll Stroke Hack Saws. Cuts are accurately "square" and clean with practically no burrs. This modern saw which is completely armoured to stand the rough handling unavoidable where large work is done, introduces the new roll-stroke principle which enables it to cut-off the toughest steel in the largest sizes rapidly and with extremely long blade life.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 BLOOMINGDALE AVENUE **CHICAGO 39, U. S. A.**

Eastern Sales Office: **225 LAFAYETTE ST., NEW YORK 12, NEW YORK**



Design for a Machine Tool Control by PARKER

Consider this as an example of the many types of machine tools that are designed to use tubing systems for hydraulic control and for lubrication.

When a machine tool tubing installation is designed in conformance with sound Fluid Power Engineering principles it will:

(1) Allow the closest practicable approach to perfect streamline flow which in turn will reduce to a minimum the capacity and pressure requirements on the power source and give a better response to control throughout the entire system.

(2) Permit the efficient use of available space . . . no matter how cramped this space may be . . . and still provide a system that allows unobstructed service and maintenance on all component units of the system.

(3) Reduce the number of joints and connections to a minimum . . . each one tight, leakproof and able to withstand excessive abuse, vibration and pressure.

Parker valves, fittings and fabricated tubing—plus Parker Engineering—will give you a simple, neat installation, easy to service, free from troubles, efficient and economical.

Whatever you make—motor vehicles, earth-movers, presses, aircraft, refrigeration or process equipment, ask a Parker engineer for recommendations based on this "know-how". Write to The Parker Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio. Booklet on request.

PARKER

Snyder Special TAPS 61 HOLES IN AIRCRAFT PART

Tapping 61 holes of various diameters and in various positions on a large aircraft housing is the job for which Snyder designed and built this automatic-cycle special-purpose machine.

When the starting button is pressed, slide and part automatically move left to the first work station where a large vertical multiple spindle tapping head and several horizontal and angular tapping units go through their automatic cycle operation.

Slide and part then automatically move right to the second work station where another group of vertical, horizontal and angular tapping spindles automatically go through their operating cycle. All tapping spindles have individual lead screws.

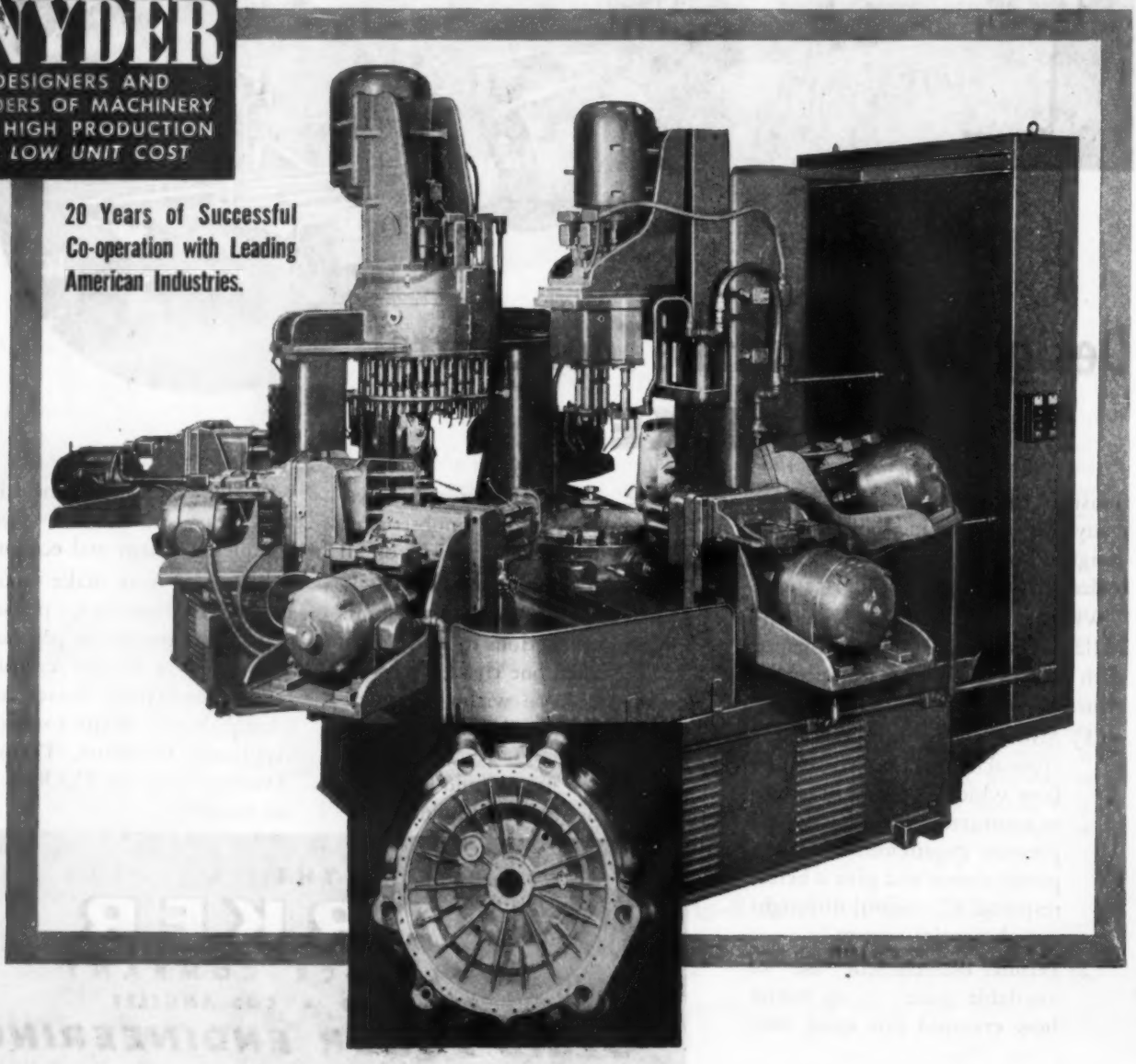
Some of these tapping units are installed on hydraulically operated sub-slides to provide rapid advance of the unit before lead screw tapping. For example, the vertical head in the left hand station has a large group of spindles on the periphery which has no hydraulic advance. However, a cluster of spindles in the center of the head is automatically advanced into tapping position several inches lower than the outer spindles.

Master control is near loading position and each tapping unit has individual push button station for set-up purposes. Machine base is welded steel.

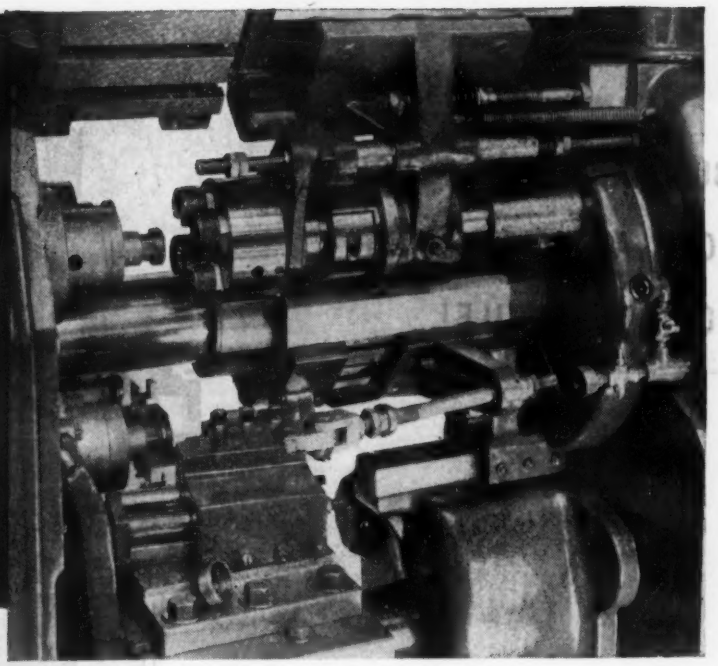
If your present or prospective operations can benefit from establishing complete control of production speed, accuracy and finish, Snyder special-purpose machine may be the answer. We invite your inquiries. *Snyder Tool & Engineering Company, 3400 E. Lafayette, Detroit 7, Michigan.*

SNYDER
DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

20 Years of Successful Co-operation with Leading American Industries.



You can CUT COSTS when you SAVE TIME



Here are both sides of a 4-spindle Acme-Gridley Chucker set up for a malleable iron pipe union, 1½" diameter, 1" long.

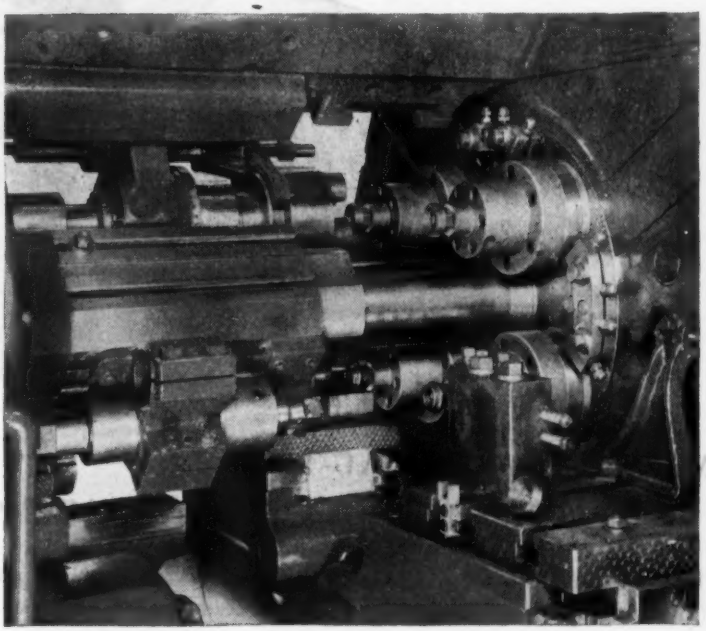
Material costs and labor costs, supervision and overhead, are all fairly constant. The one great variable is TIME.

Do the job faster and you cut the cost of production.

No matter what kind of chucking work you have, the Acme-Gridley Chucking Automatic—4, 6 and 8-spindle—will help you turn it out faster, without any sacrifice of precision.

More tools at work—more operations at the same time—made possible by large, accessible tooling area and independently controlled attachments. Work easy to handle, less operator fatigue.

Many users tell us about cost reductions as high as 50% to 75%, as compared with former methods.



This booklet shows you 25 Chucking Jobs on which money was saved. Some of the parts may be just like those you make. Send—on your letterhead—for a copy.

The NATIONAL ACME CO.

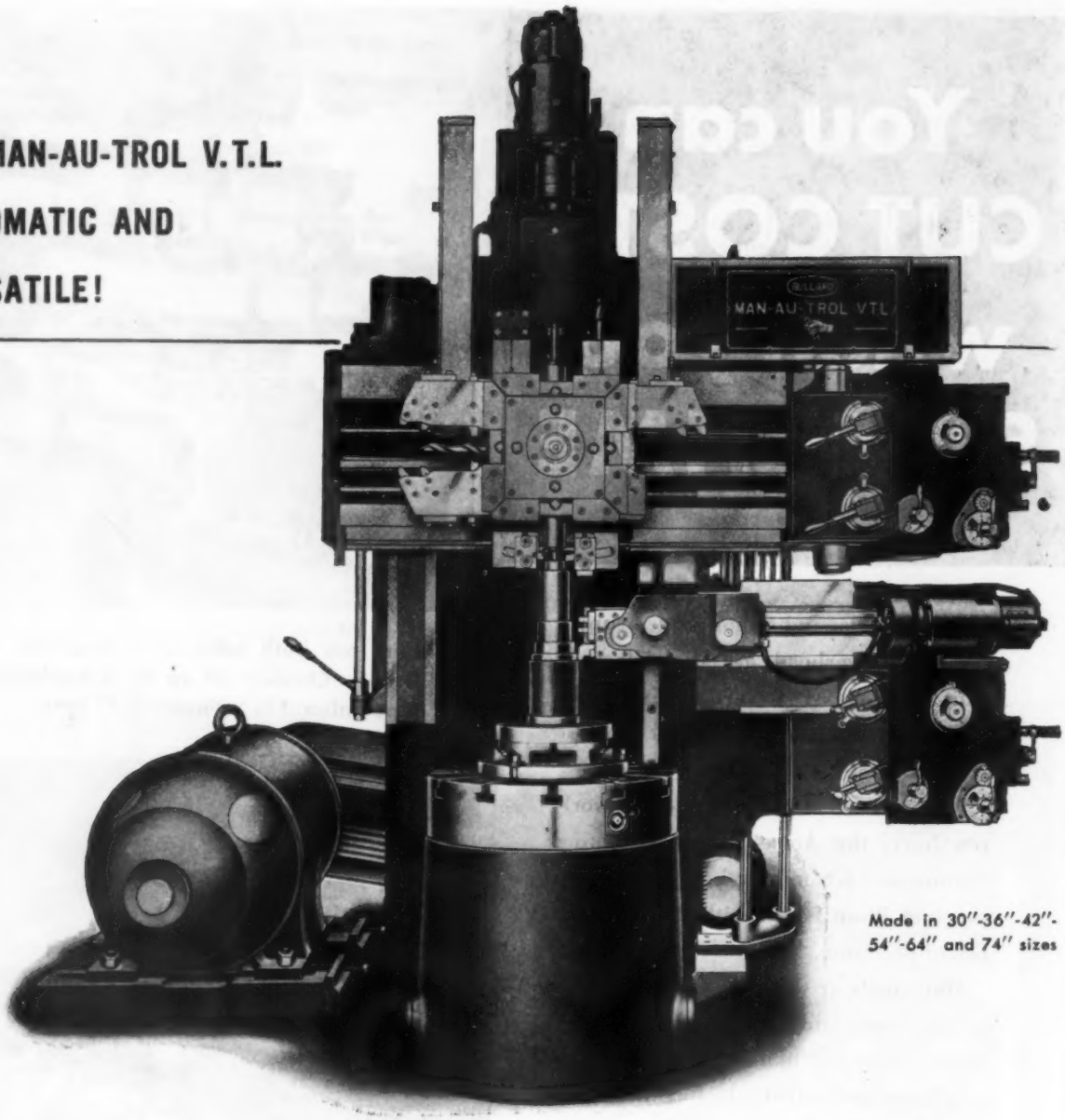
170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley 4-6 and 8 Spindle Bar and Chucking Automatics • Single Spindle Automatics • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

BULLARD MAN-AU-TROL V.T.L.

100% AUTOMATIC AND

100% VERSATILE!



Made in 30"-36"-42"-54"-64" and 74" sizes

Made possible by MAN-AU-TROL . . .

The automatic control that is as versatile as manual control

This new Bullard MAN-AU-TROL V.T.L. does *automatically* any and every job (involving up to 40 functions of the Main Head and 40 additional functions of the Side Head) that a manually-operated vertical turret lathe can do. Does it faster to a degree of repetitive accuracy no man can match. Cuts down setup time from one class of work to another . . . without cams or similar wearable parts. Can be converted instantly to manual operation on any entirely different piece without disturbing the automatic setup of the MAN-AU-TROL. All the while — the operator supervises production.

Think what this means to you. With a Bullard MAN-AU-TROL V.T.L. you can economically machine long runs or single units . . . can protect yourself against changes in specifications . . . can give yourself a tremendous cost advantage in competitive markets.

For complete details, write today for new bulletin on the new Bullard MAN-AU-TROL V.T.L. The Bullard Company, Bridgeport 2, Connecticut.

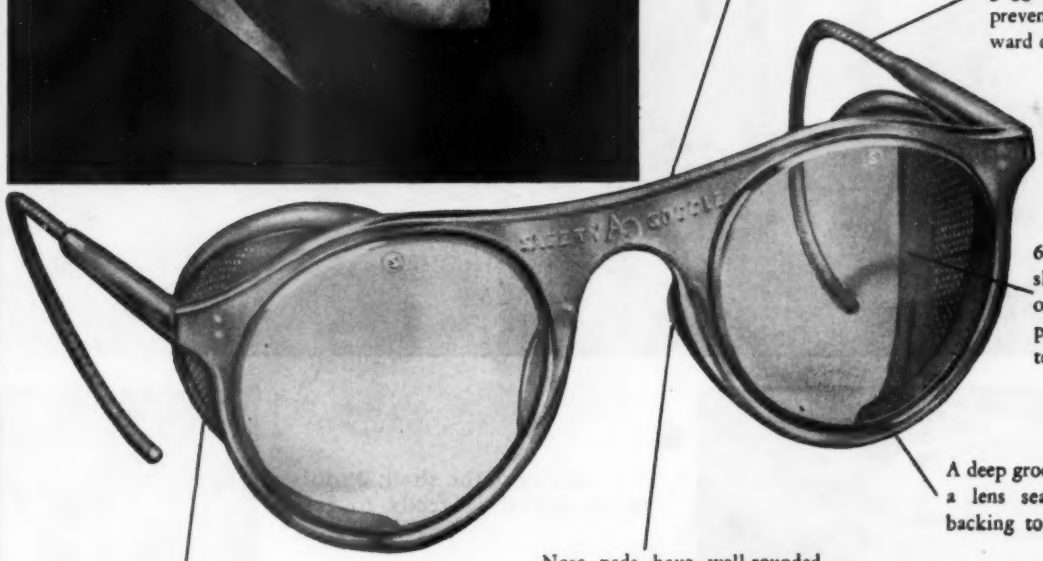
BULLARD
MAN-AU-TROL
MASTER OF THE MACHINE

BULLARD CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

6 FEATURES make AO FUL-VUE ACETATE GOGGLES..... SAFE, COMFORTABLE, ATTRACTIVE

Stronger, more sturdy front than on ordinary acetate frames. Bridge has a slight amount of face form to give added side protection.

Comfort cable temples hold goggles snugly in position—prevent them from sliding forward on nose.



6-curve Super Armorplate lenses shaped to conform to and cover orbit of eye, provide maximum protection and vision, plus better appearance.

A deep groove in lens rim forms a lens seat with substantial backing to resist *severe* impact.

Nose pads have well-rounded edges and ample flare to withstand ordinary jolts and blows.

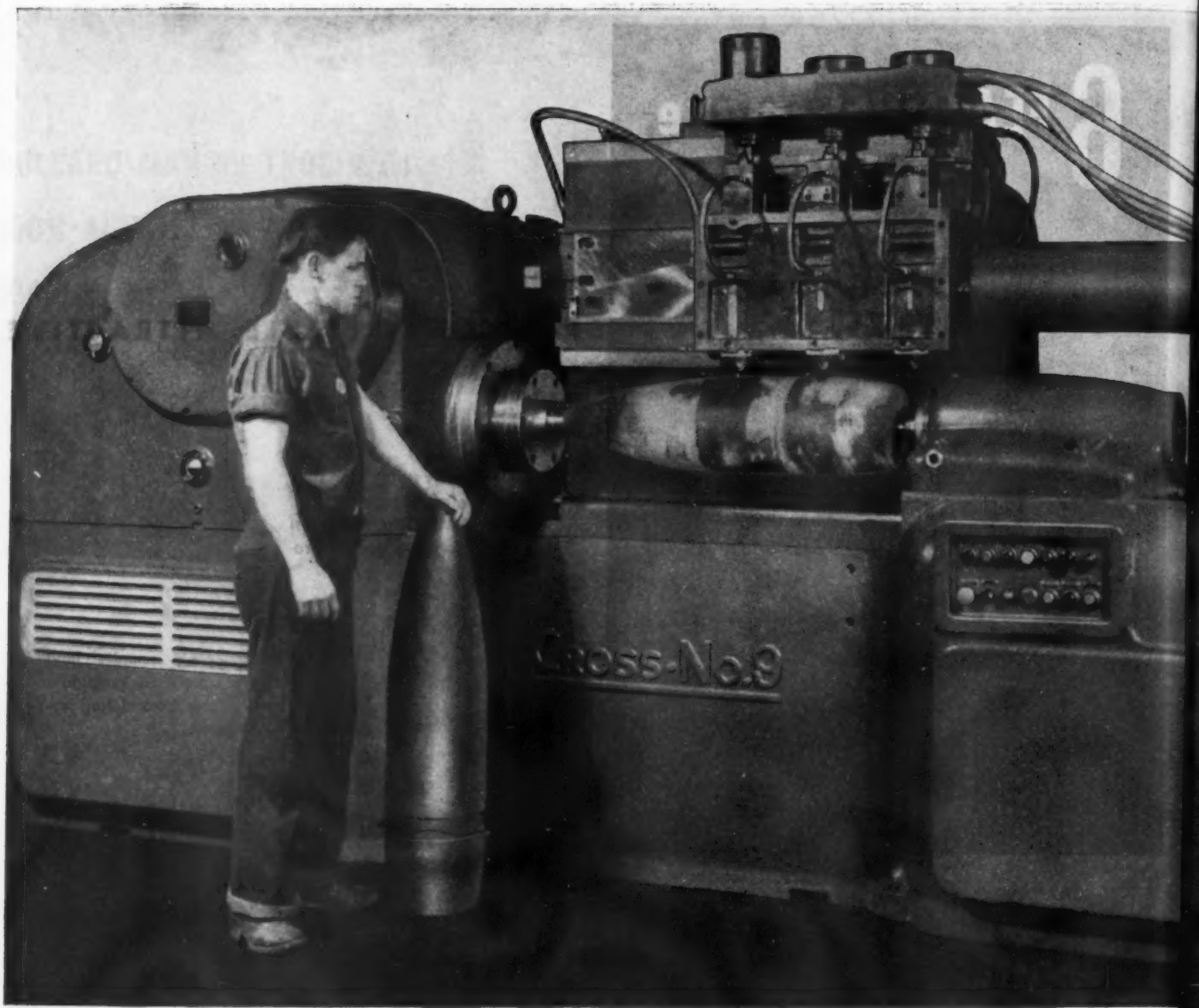
Acetate side shields protect against particles striking from sides. Perforated to provide ventilation and help keep lenses from fogging.

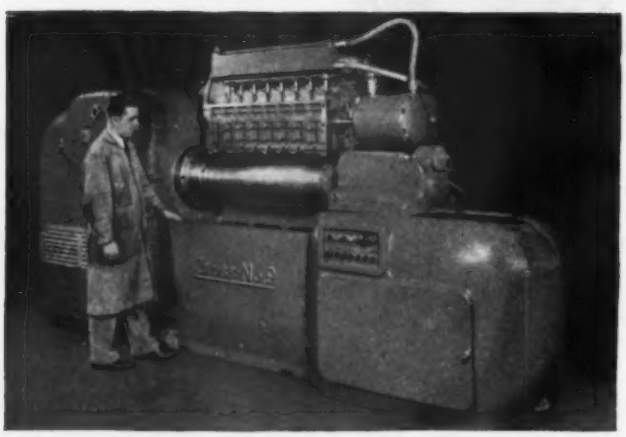
AO Ful-Vue Acetate Goggles come in three eye sizes and three bridge sizes—made in transparent acetate, with or without side shields, with clear or Calobar 6-curve Super Armorplate lenses. Your nearest AO Representative can supply you. Call him today.

American Optical

COMPANY

SOUTHBRIDGE, MASSACHUSETTS

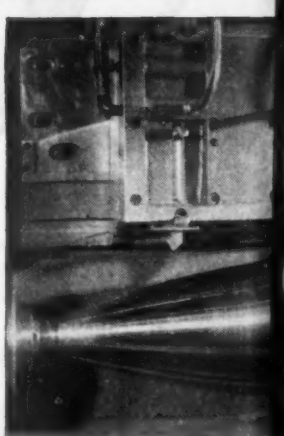




1—In finishing the shell, 2 tools cut as the slide feeds to left.

2—The slide rapid-returns part way and starts feeding to right as a third tool enters the work to produce the bourrllet.

3—Roughing a 240 mm. shell, cutting with 12 tools simultaneously.



CROSS

New York • Chicago • DETROIT • Cleveland • Dayton

The Means to an End...

This machine is only the means to an end, which is mass production of shells—the same as the ammunition is a means to an end of the war. What form, size, power or production a Cross Special Machine will have depends on the job requirements. That is the Cross method of supplying machinery.

This machining problem, as presented to Cross by the manufacturers of 105 mm., 155 mm., 8-inch and 240 mm. shells, called for special machines capable of "hogging off" metal continuously to very close tolerances—and using unskilled labor, frequently women, due to the lack of experienced machine operators.

Cross Special Shell Lathes were designed and built around these customers' needs. That they are meeting these requirements is evidenced by the swift, steady flow of shells coming off the production lines, which operate 24 hours a day with whatever help is available.

Cross Engineering Service is offered to you on problems involving milling, drilling, boring, reaming, tapping, turning and grinding. Send for the Cross booklet containing many case histories of Cross Special Machines. A descriptive Shell Lathe Bulletin is also available. Address Department 111.

THE CROSS COMPANY, DETROIT 7, MICH.

MACHINE TOOLS

SPECIAL MACHINES

for automatically performing any one or a combination of metal cutting operations
TURNING · MILLING · DRILLING · BORING · REAMING · TAPPING · GRINDING

CUTTER LIFE TRIPLED

BY Cold Treating IN Deepfreeze Industrial Chilling Machine

Read how this manufacturer gets more pieces per sharpening and reduces machine down time milling hard forgings . . .

This large mid-western manufacturer of automotive brake equipment has experienced a 200% increase in the life of standard 4-inch milling cutters used to machine extremely hard forgings by Cold Treating in a Deepfreeze Industrial Chilling Machine. In addition, the number of pieces milled per sharpening was materially increased after Cold Treating with a corresponding decrease in machine down time.

Why Cold Treating Increases Tool Life

What Cold Treating has done for this manufacturer is typical of results obtained in hundreds of plants—results which you can duplicate on your high-speed steel cutting tools.

This is true because Cold Treating at −120° F. in a Deepfreeze Industrial Chilling Machine produces structural transformations which result in the optimum combination of hardness and toughness. This resultant structure of the high-speed steel has greater wear and breakage resistance. Tools thus treated retain their sharpness longer, producing more pieces per grind.

Learn How Cold Treating Can Save You Money

To determine what economies you can obtain by Cold Treating all high-speed steel cutting tools used in your plant, consult the Deepfreeze Engineering Service. The wide field experience of our engineers and our modern metallurgical laboratory facilities are at your disposal to outline proper Cold Treating procedures for the solution of your tool hardening problems. Your request for this service does not obligate you in any way.

FREE . . . *Cold Treating Data Book*

Here is authoritative, up-to-the-minute data on the use of Cold Treating for hardening high-speed steel cutting tools. In this handy working guide on the use of industry's newest production tool you also get detailed procedures on the use of sub-zero temperatures for shrinking, testing, and stabilization of metals. This book deserves a place in your files. Your free copy of the Deepfreeze Metal Chilling Data Book can be obtained by writing Deepfreeze, North Chicago, Illinois.

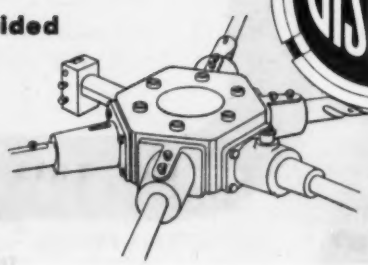
WORK SAFELY!

DON'T TAKE CHANCES!

- ✓ Use the guards and safety devices provided on your machine.
- ✓ Wear goggles wherever chips fly.

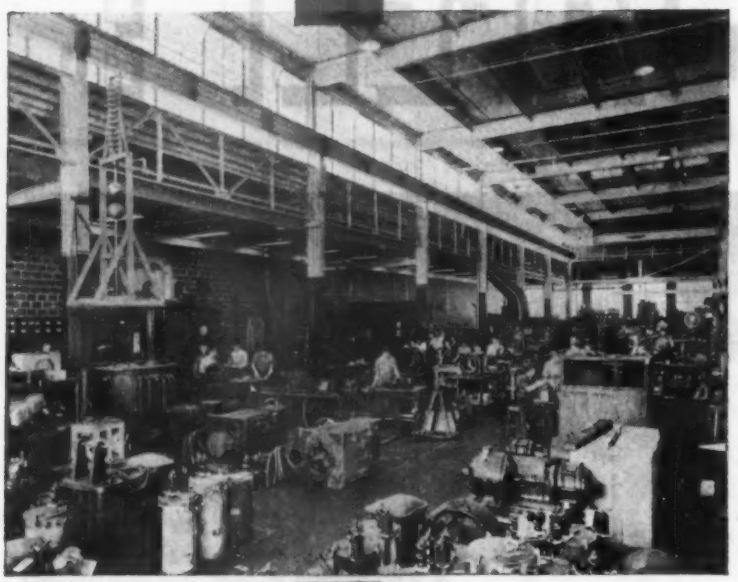
UNCLE SAM NEEDS YOUR PRODUCTION— *NOW*

GISHOLT



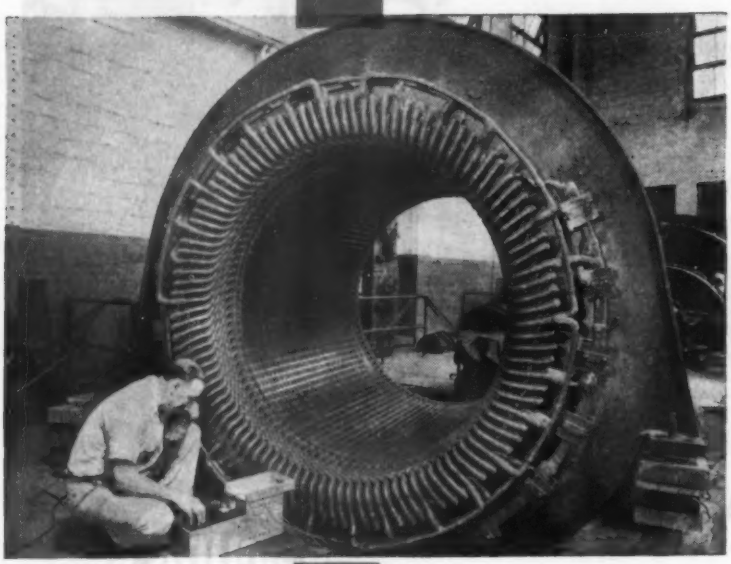
✓ *Reproductions of this page on enameled paper are available in 8¼" x 10½" size for bulletin-board use in your turret lathe department. Write the Gisholt Machine Company, 1201 East Washington Avenue, Madison, Wisconsin. Ask for the series of "Wartime Care and Operation Posters." State quantity desired.*

FACTORY-PROVED



FOR LONGER-LASTING REPAIRS OUTSIDE YOUR PLANT

There is a Westinghouse Manufacturing and Repair plant near you to give you prompt "Factory-Proved" service on electrical repairs. Check opposite page to see what "Factory-Proved" service means in keeping electrical equipment up to par.



FOR FASTER REPAIRS IN YOUR OWN PLANT

. . . use Westinghouse Field Engineering and Service. Factory-trained engineers are available to diagnose trouble, and work with your own people to speed up repairs. Portable field equipment assures accurate results.

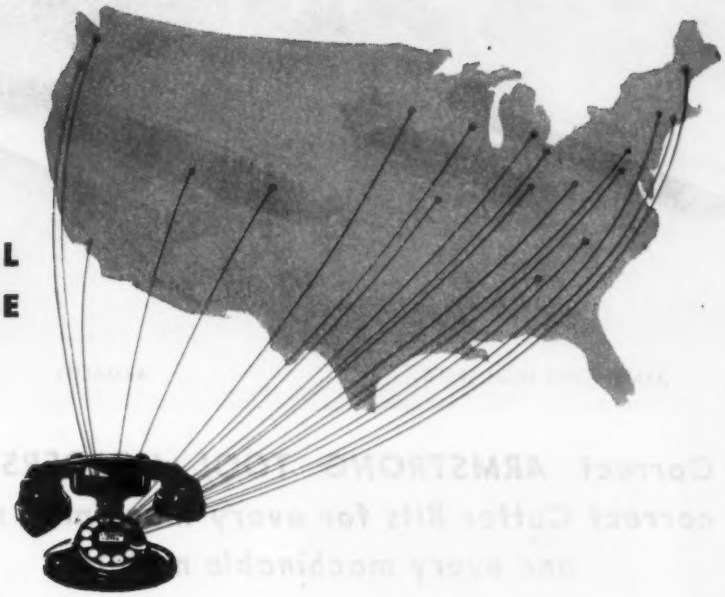
WESTINGHOUSE

GET THIS FREE CHART FOR YOUR MEN

THE "FOUR FIRSTS" OF MOTOR MAINTENANCE

Handy wall chart for your maintenance department, stressing the four most common causes of motor failure and the precautions to take against them. Write for Chart SA-783. Westinghouse Electric & Mfg. Co., P. O. Box 868, Pittsburgh 30, Pennsylvania.

MAINTENANCE



A NATIONWIDE ELECTRICAL REPAIR SERVICE... AS CLOSE AS YOUR TELEPHONE

Men who have helped to build electrical equipment naturally know the most about repairing it. That's the solid basis upon which Westinghouse "Factory-Proved" Maintenance is founded.

This nationwide service organization thus offers you an important plus value—"Factory-Proved" repair and engineering service on a *local* basis.

In the Westinghouse Field Engineering and Service and in the near-by Manufacturing and Repair plant, are men who have spent years acquiring electrical "know-how". They have helped to build motors, generators, controls. They have been specially trained in factory methods of reconditioning and repair.

Backing them up is the most modern type of precision equipment. Testing is handled according to rigid factory specifications—including high-frequency testing, dynamic balancing of rotating parts, fatigue tests, etc.

Because of these special facilities and methods, Westinghouse is in a position to give you—through its District Offices and repair plants *in or near your own city*—the same guarantee on repaired equipment as on new equipment.

Don't overlook the advantages of this "Factory-Proved" repair service in keeping your electrical equipment at peak efficiency. Call nearest Westinghouse Office for prompt service on any repair job—inside or outside your plant.

FOR PROMPT SERVICE ON RENEWAL PARTS

. . . call your Westinghouse Sales Office. Ample stocks of Westinghouse factory renewal parts are available at all times. To speed minor repairs, build up your own stocks of parts most subjected to wear.

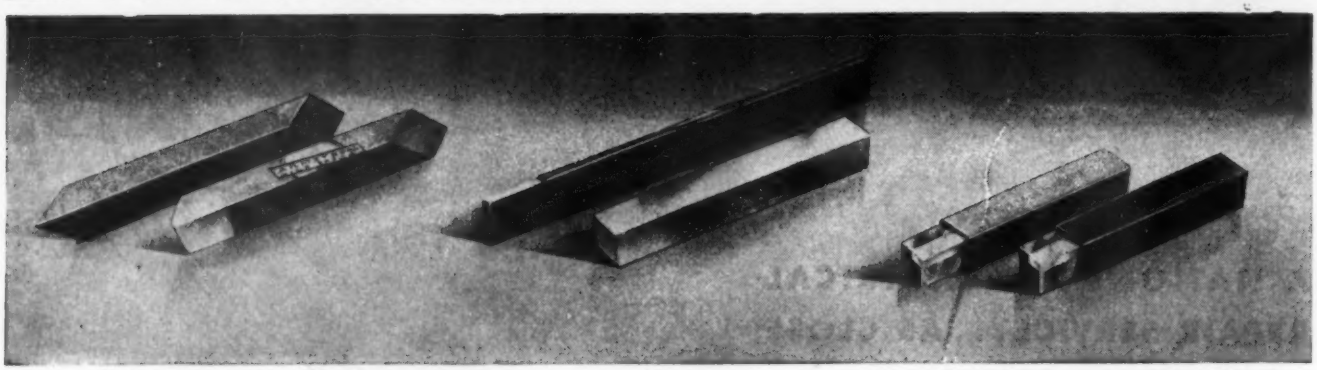
Westinghouse Electric & Manufacturing Co., P.O. Box 868, Pittsburgh 30, Pennsylvania. J-96001

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

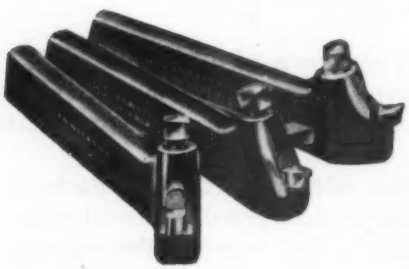
Maintenance Service

ARMSTRONG



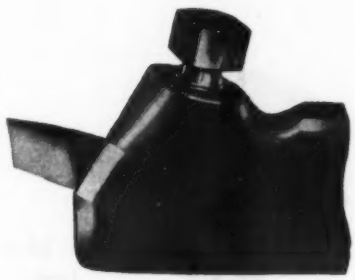
ARMSTRONG HIGH SPEED | ARMALOY | ARMIDE

Correct ARMSTRONG TOOL HOLDERS and correct Cutter Bits for every machining speed and every machinable material



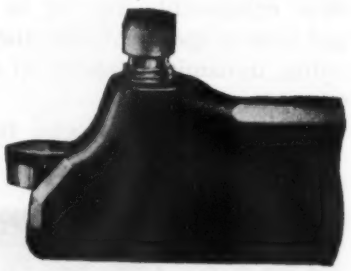
The Armstrong System of Tool Holders provides correctly designed ARMSTRONG TOOL HOLDERS for every operation of lathes, planers, slotters and shapers and for many turret lathes and screw machine operations. It also provides proper types of cutters, bits and blades for every cutting-speed and material.

- For general tool room and machine shop use ARMSTRONG HIGH SPEED Bits and Blades are unsurpassed. They will stand up to speeds and feeds far greater than those generally accepted as "standard".
- ARMALOY Bits and their corresponding ARMSTRONG CA TOOL HOLDERS are recommended for machining sand-fitted castings, malleable iron, non-ferrous metals, rubber, plastics and for machining steel on modern high production machines, where sufficient speed and feed can be obtained to take advantage of their greater cutting capacity.
- ARMIDE Carbide-Tipped Cutters and ARMSTRONG Carbide Tool Holders, make the use of Carbide-tipped tools practical in even the smallest shop. Coming in two grades ARMIDE Red (for steel) and ARMIDE Gray (for cast iron, brass, aluminum and non-ferrous materials). They easily machine hard and tough steels, and stand up to the highest speeds and heaviest feeds, and increase the interval between tool re-grindings as much as 10 to 50 times.



ARMSTRONG TOOL HOLDERS for HIGH SPEED CUTTERS

ARMSTRONG CA TOOL HOLDER for ARMALOY CUTTERS



ARMSTRONG *Carbide* TOOL HOLDERS for ARMIDE CUTTERS

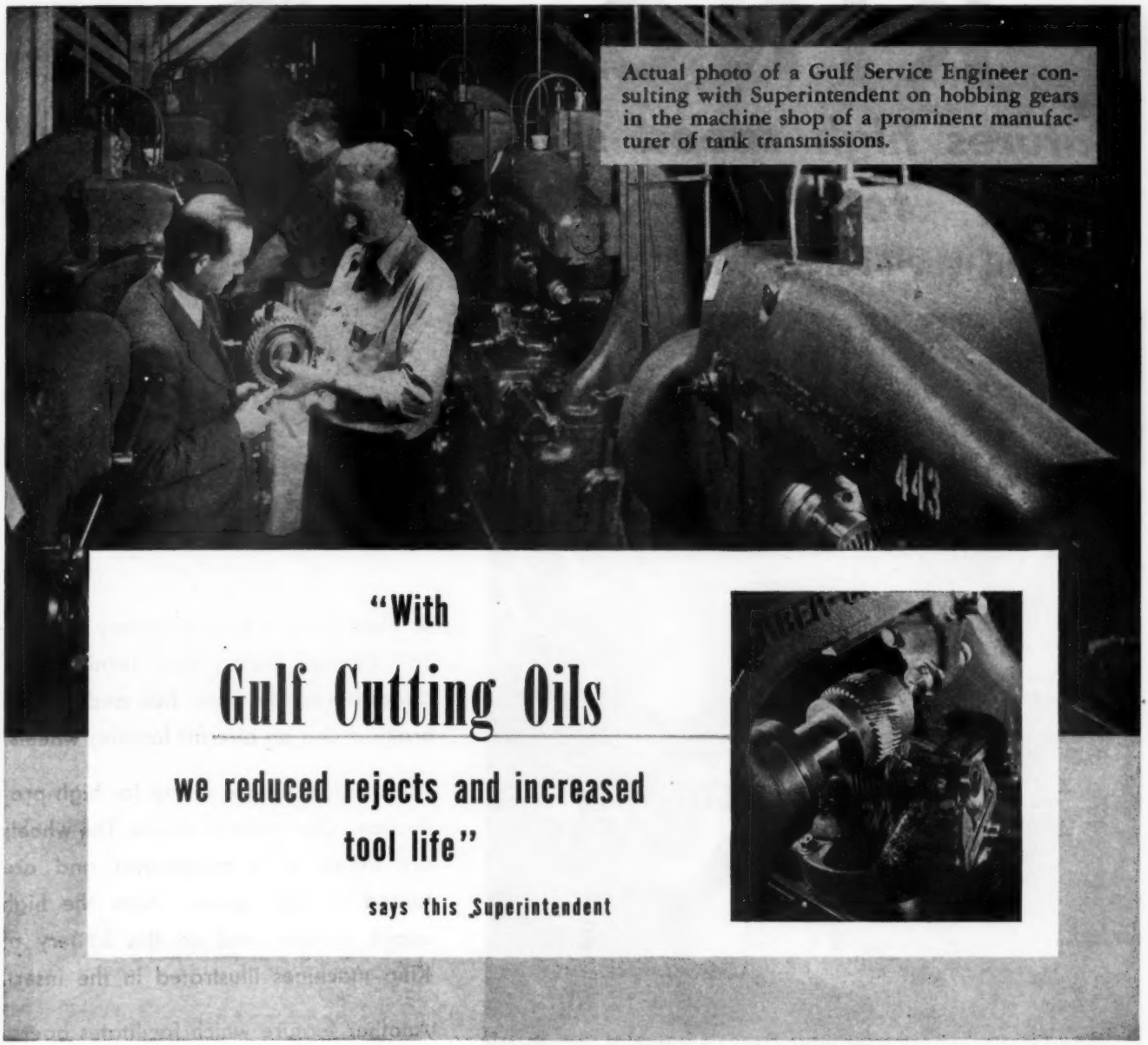
ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

315 N. FRANCISCO AVENUE — CHICAGO 12, U. S. A.

Eastern Whse. & Sales: 199 Lafayette St., New York 12, N. Y.
Pacific Coast Whse. & Sales Office: 1275 Mission St., San Francisco 3, Calif.

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms



Actual photo of a Gulf Service Engineer consulting with Superintendent on hobbing gears in the machine shop of a prominent manufacturer of tank transmissions.

"With

Gulf Cutting Oils

we reduced rejects and increased tool life"

says this Superintendent

GULF CUTTING OILS have been a big help to us in exceeding our production goal," says this Superintendent. "By switching to these improved oils, we eliminated rejects due to tearing, and made a substantial increase in tool life."

Again and again, Gulf Cutting Oils have set new standards of performance for tough jobs in hundreds of aircraft, armament, and munition plants. And war production reports on Gulf Cutting Oils have a peacetime value: These quality cutting oils can give important help to shops seeking lower costs for aggressive competition in the postwar period.

Gulf Cutting Oils are available to you through 1200 warehouses located in 30 states from Maine to New Mexico. Write, wire, or phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

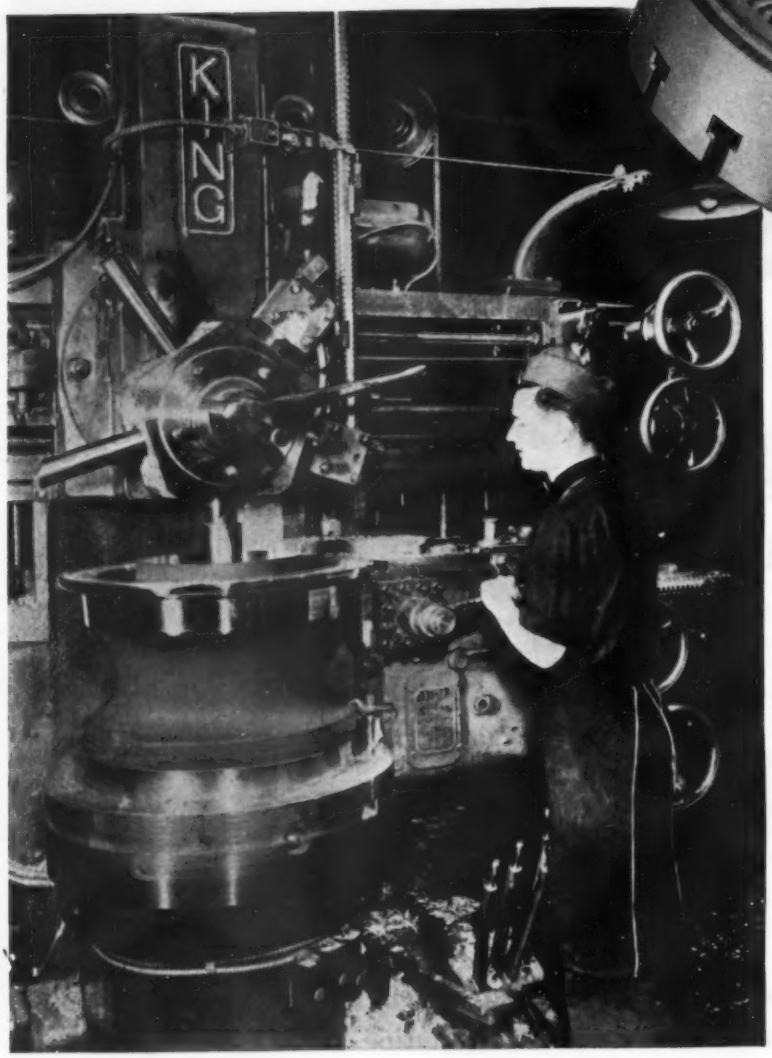
Gulf Oil Corporation · Gulf Refining Company

Gulf Building, Pittsburgh 30, Pa.

KING

features high speed spindle for

TURNING MAGNESIUM WHEELS



● Illustrating one of a battery of King 36" Vertical Boring and Turning Machines boring the inner hub and turning brake drums on aircraft landing wheels.

These machines are set up for high production. Operation is simple. The wheels are made of a magnesium and are turned at high speed. Note the high speed spindle used on this battery of King machines illustrated in the insert.

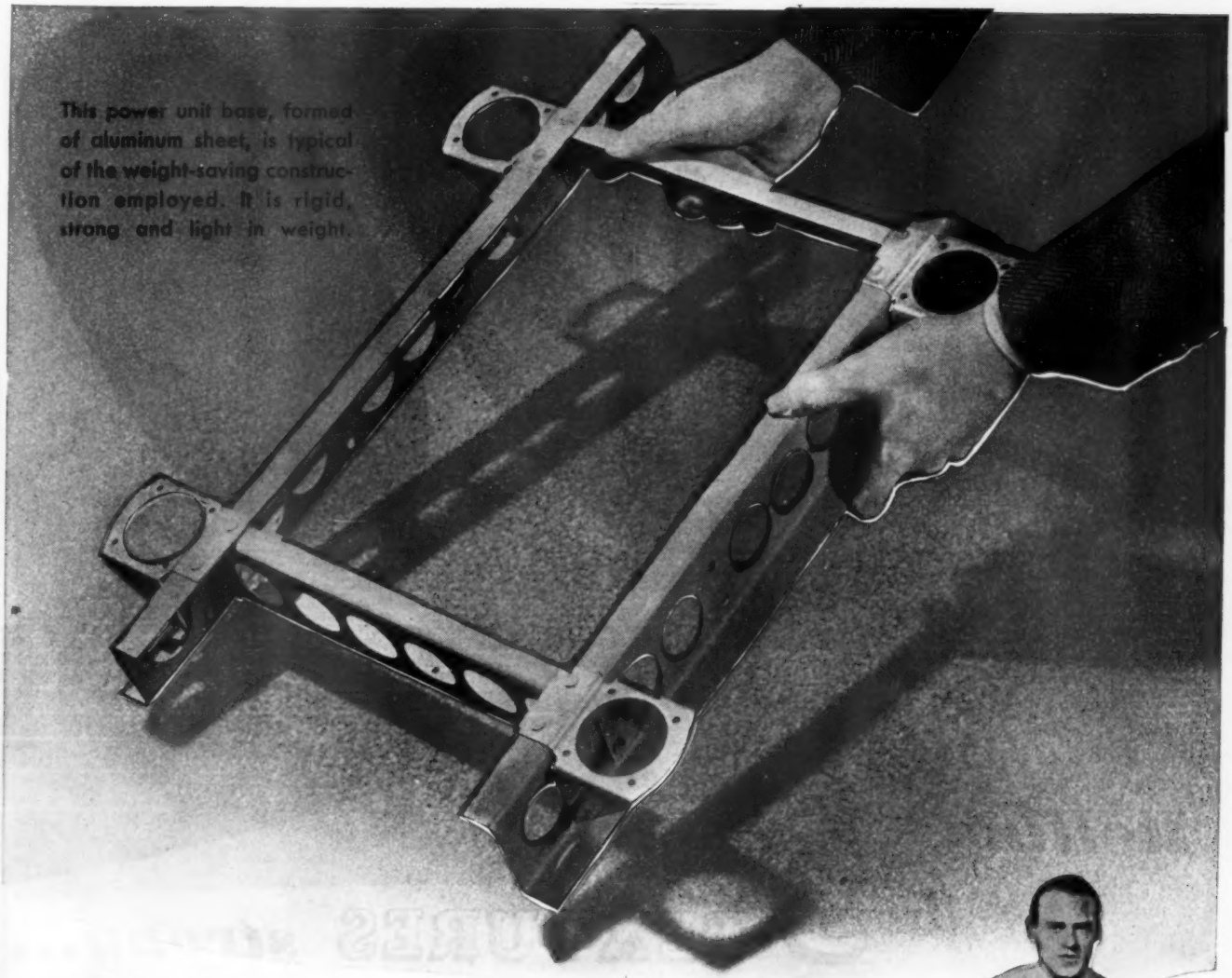
Another feature which facilitates operation and insures exact duplication is the full electric control to turret and side head. This mechanism provides full automatic stops for turret and side head—operator merely throws in the feed and tools stop automatically when cut has reached required depth.

For greater production—closer tolerances—lower costs—investigate the many advantages of King Vertical Boring and Turning Machines.

KING BUILDS Vertical Boring & Turning mills in single column types from 30" to 42"—double column types up to 12 feet.

THE KING MACHINE TOOL COMPANY
CINCINNATI 32, OHIO

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY



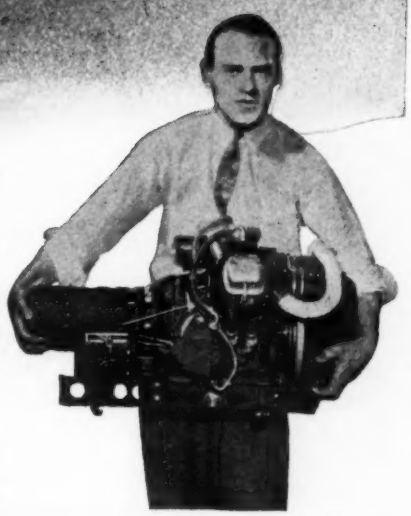
This power unit base, formed of aluminum sheet, is typical of the weight-saving construction employed. It is rigid, strong and light in weight.

Hitchhiker with a mission . . .

This little engine-generator set often goes along just for the ride. But let a plane crew need any auxiliary power, and it goes to work. Made largely of Alcoa Aluminum, it packs a lot of power per pound of weight.

Already we're seeing these lightweight engines aiding the civilian war effort. Chugging away faithfully alongside open manholes, they supply fresh air to the men below, pump out water, and floodlight the work. Alcoa predicts a widespread use of such equipment, made portable with weight-saving aluminum.

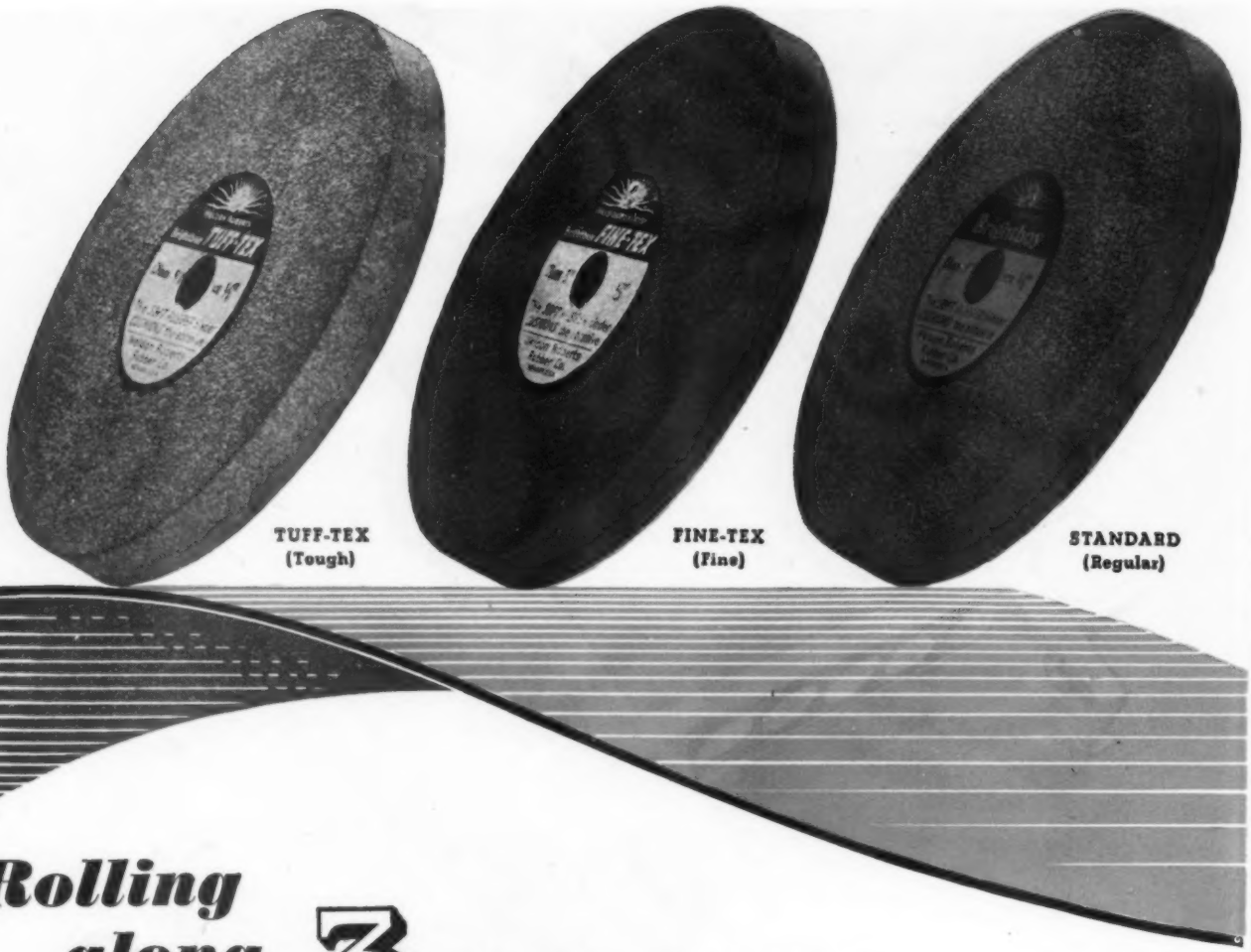
Thinking of using aluminum sheet on parts like that base? Our engineers will gladly assist in selecting materials and working out forming and assembly operations. ALUMINUM COMPANY OF AMERICA, 2107 Gulf Bldg., Pittsburgh 19, Pa.



This Andover Auxiliary Power Unit weighs only 116 pounds.

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM



TUFF-TEX (Tough)

FINE-TEX (Fine)

STANDARD (Regular)

Rolling along, 3 TEXTURES *strong...*

for a one-operation job in

BURRING • FINISHING • POLISHING

BRIGHTBOY TUFF-TEX

Tougher texture, for finishing hard metals. The tougher binder accents the abrasive action, yet retains the soft rubber cushion, finishing and polishing in one operation.

BRIGHTBOY FINE-TEX

Smoother, finer texture for work on softer metals, producing special finishes and for applications where the coarser wheel might not be suitable.

BRIGHTBOY STANDARD

Brightboy STANDARD texture is a favorite for burring, finishing and polishing on the widest variety of metals and metal parts.

Rubber-cushioned Brightboy abrasive products bridge the grind-to-buff gap in close-tolerance finishing and polishing—on alclad, dural, aluminum, stainless, monel, brass, bronze, copper, silver and plastics. There are THREE Brightboy textures, each "cushioned" and precision-controlled by Brightboy's resilient rubber binder.

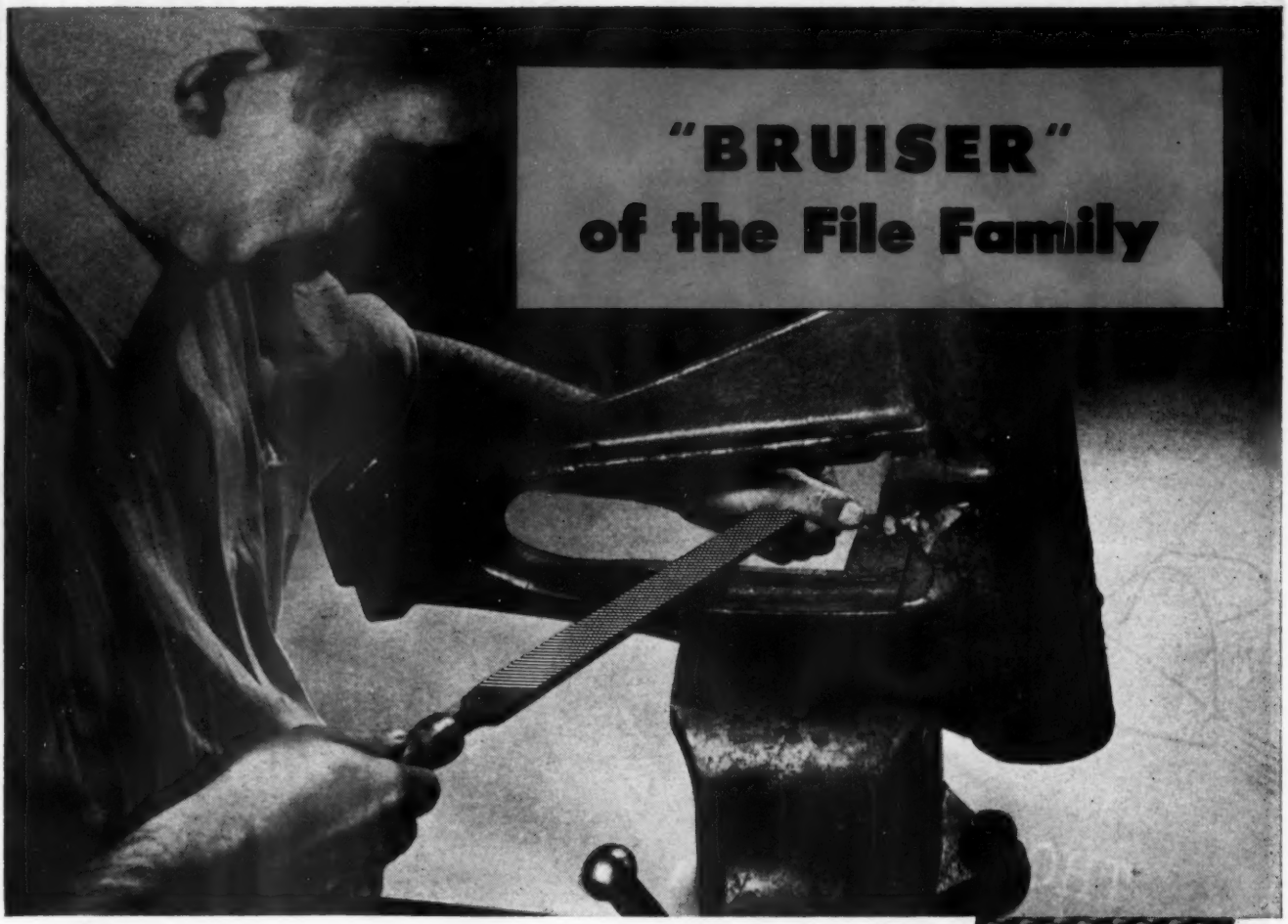
If you have never seen a Brightboy finish, it will be a revelation to you. Ask your distributor for Brightboy production literature, prices and catalog. Ask Brightboy field representatives to show you an example of a Brightboy finish and also to suggest production short-cuts to better finishing.

BRIGHTBOY INDUSTRIAL DIVISION

Weldon Roberts Rubber Co. **Newark 7, N.**

WELDON ROBERTS

Brightboy



THE Nicholson Special Purpose Foundry File is a "roughneck" because it has to deal with tough adversaries. Teeth are stocky and sturdy, with heavy-set edges to resist shelling and breaking out. Designed for rough filing beyond the service expected of regular files—like knocking off fins, sprues and other hard projections from rough castings. Or filing narrow edges and sharp corners of dies.

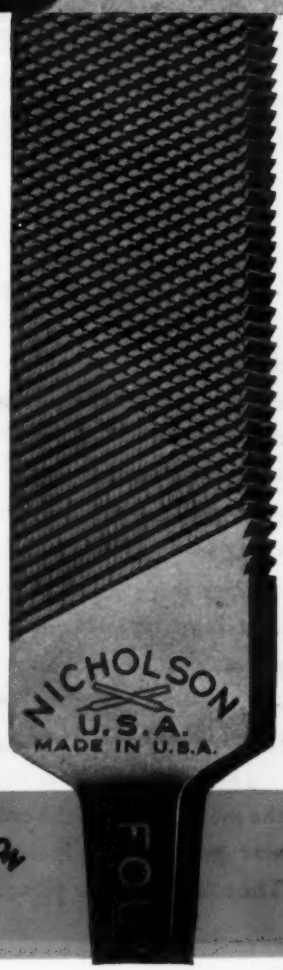
To the special features, add the over-all high Nicholson standards of steel specifications, accuracy in cutting, uniformity in hardening, and rigid inspection and testing . . . and it becomes understandable why the Nicholson guarantee of *Twelve perfect files in every dozen* is safely within the definition of the most exacting user.

Made in sizes from 8″ to 14″. Stamped "Foundry."

• ***Other Nicholson Special Purpose Files*** include files for: Aluminum, Stainless Steel, Brass, Lead, Die Castings, Die Making, Lathe Filing, plus milled curve-tooth files and a wide range of Swiss Pattern Precision Files. Consult your mill-supply house. Or WRITE FOR TECHNICAL BULLETINS.

FREE BOOK, *"FILE FILOSOPHY"*—an excellent illustrated 48-page "handbook" on kinds, use and care of files. Helpful to production and purchasing heads, foremen, master mechanics.

NICHOLSON FILE CO. • 29 ACORN STREET, PROVIDENCE 1, RHODE ISLAND
(In Canada, Port Hope, Ont.)



NICHOLSON FILES NICHOLSON U.S.A.
FOR EVERY PURPOSE

Thor portable electric screw drivers
Reduce assembly costs—
Speeds unit operations—
Increase fabrication range—

War plant production executives in search of portable electric tools have learned to look to Thor for fast, efficient and low cost equipment. This was the line they found to be complete—not only in the kinds of tools but in the variety of models to provide the correct tool for every kind of job.

Thor tools are built for three shift industrial production work with the ample power that assures continuous service yet are so designed that weight and consequent worker fatigue is cut to a minimum.

There are just two of the reasons why the men on whom the country depends for war goods have learned to depend on Thor for portable power tools.

Just as soon as you finish making war supplies the reconversion rush will be on—the rush to prepare for civilian goods again. During this reconversion period Thor tools will be in great demand for the tremendous change-over necessary to prepare for the manufacture of peace-time articles. The post war market is estimated to be the greatest in world history. Anticipating your tool needs now you will be in a better position to meet the heavy demands for reconversion and post war production; to give your workers full employment; your company its full share of peace-time profits.

Typical of Thor developments are portable electric screw drivers which not only have brought greater speed and accuracy to assembly operations but will speed the race to rebuild peace-time production lines.—Installation of machines, wall partitions—a thousand other screw driving and nut setting jobs must be done fast to rebuild for productive output.

The tools are available in all speeds and types. The wide variety of attachments are particularly suited to various special operations to make them valuable in rebuilding for peace-time operation—essential for low cost mass production of civilian goods.

THOR TOOLS for Refrigerators

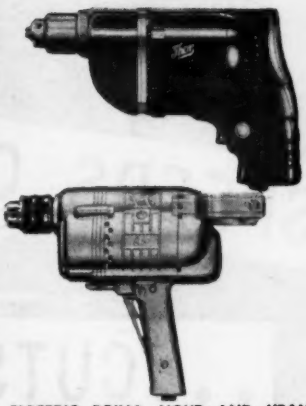
New Designs of Thor Tools

Not only will a great variety of new products be made in the future but old products will be made in a greater variety of new ways. In this need for adaptability, production men will remember that Thor has consistently led in the design and development of new and more efficient tools. Today there are more new tools in the Thor experimental laboratory than at any time in Thor history. Just as quickly as these new Thor tools are proved perfect, in laboratory and shop tests, they become a regular part of the Thor line.

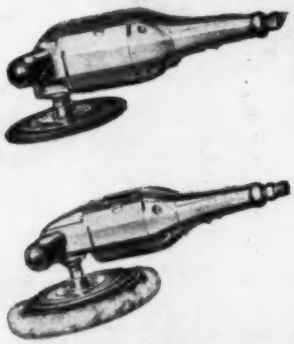
When you are again ready . . .

to manufacture refrigerators, electric irons, toasters or whatever, Thor will have the portable tools you will need . . . engineered, designed and built for long, hard, continuous service on top speed production. Since 1893 virtually every major improvement in portable power tools has come from the Thor laboratories. That is why you can safely anticipate your tool requirements NOW and be sure of getting, with Thor, not only the *best* tools, but the tools you need when you need them most.

INDEPENDENT PNEUMATIC TOOL CO.
600 W. Jackson Boulevard, Chicago 6, Illinois
New York Los Angeles



ELECTRIC DRILLS—LIGHT AND HEAVY DUTY DRILLS in a complete range of capacities from ¼" up to 1¼" for continuous or intermittent service are available in the complete Thor line of portable electric tools.

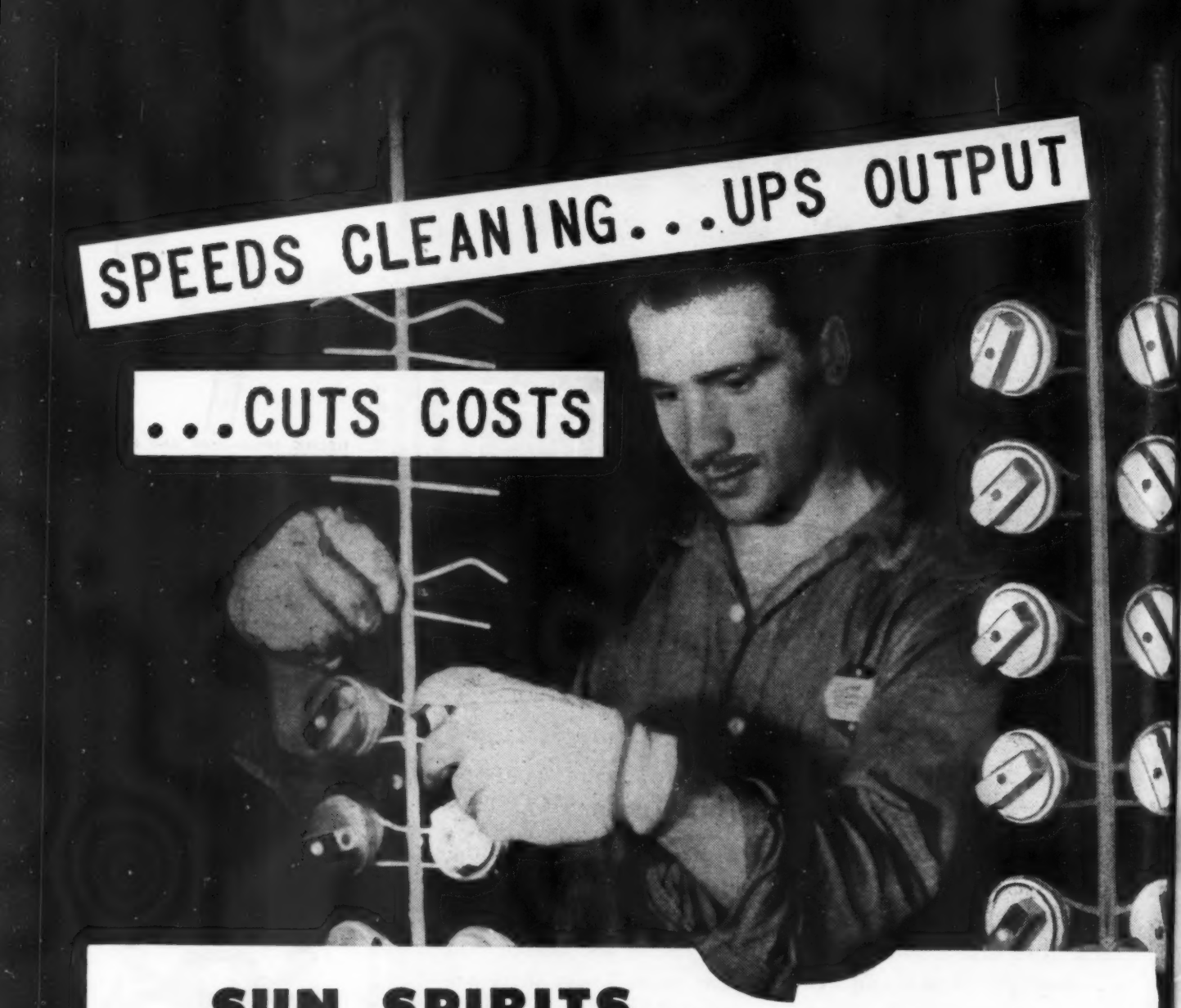


ELECTRIC SANDERS AND POLISHERS— THOR 7" AND 9" DISC SANDERS for all metal finishes are sturdy and easy to handle. A THOR POLISHER produces a brilliant durable finish, saves time and effort.

ELECTRIC GRINDERS—4", 5" AND 6" DIA. WHEEL Portable Grinders for fast grinding, wire-brushing and buffing on all metal surfaces. 6", 7" AND 10" BENCH GRINDERS in light or heavy duty types are a shop necessity.

Thor PORTABLE Electric TOOLS

Branches in Principal Cities



SUN SPIRITS...

slashes drying time...cuts costs...speeds shipments

When metal cleaning troubles slow down output of war parts, they *must* be eliminated. And, as one New England ordnance plant recently discovered, these problems can be easily overcome.

Slow cleaning of vital metal parts "bogged" down their production. The cleaning solution they used dried very slowly, preventing them from meeting shipping schedules. High price of solution raised costs.

Troubles faded when a Sun Oil Engineer recommended a change to Sun Spirits. Parts now come out sparkling clean . . . and dry in a hurry. Shorter cleaning time made it possible to ship parts the same day they are machined. And Sun Spirits is only one-sixth the cost of previous cleaner used.

Why not call a Sun Oil Engineer for assistance in solving similar problems in your plant? Remember . . . Sun offers its "know-how" along with a complete line of petroleum products for industry. Write . . .

SUN OIL COMPANY · ***Philadelphia 3, Pa.***

Sponsors of the Sunoco News Voice of the Air — Lowell Thomas

SUNOCO **SUN INDUSTRIAL PRODUCTS**

OILS FOR AMERICAN INDUSTRY

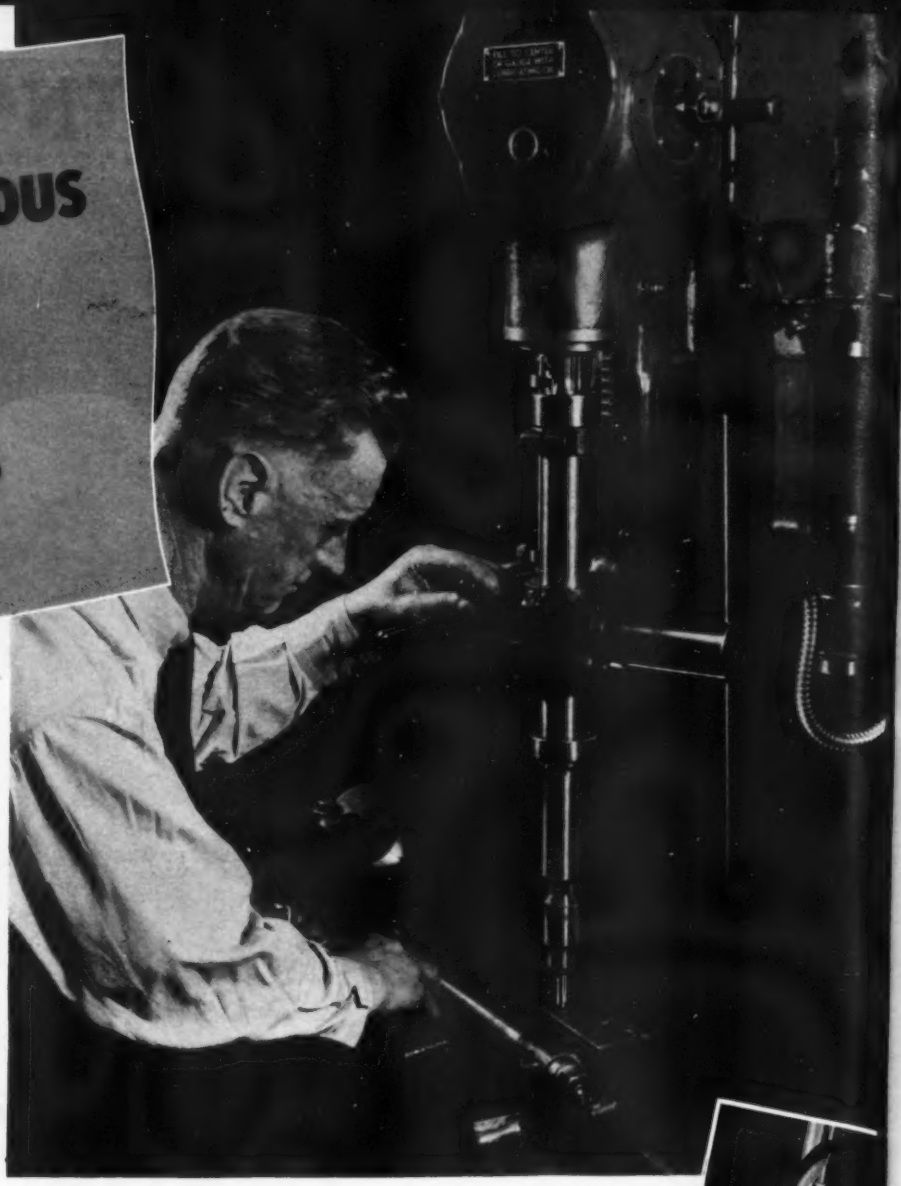
For Centerless Grinding

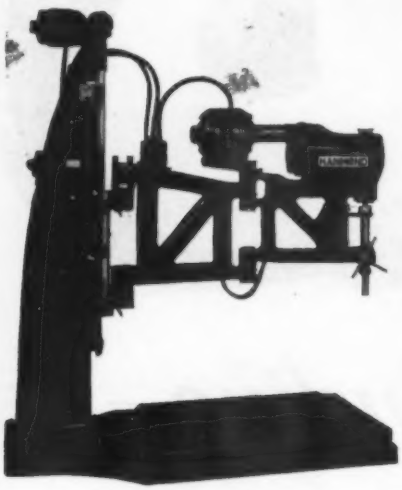
Specify Sterling—"The Wheels of Industry"
Grinding Wheels of Finest Quality
Sixty Years of Building the Best in Grinding

Sterling's "H" Bond permits the widest possible application of "The Wheels of Industry" to the demands of modern centerless grinding. . . . .

• STERLING ABRASIVES •
THE
STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO
THE WHEELS OF INDUSTRY

For miscellaneous in-the-line operations





For those miscellaneous holes that cannot be handled on multiple spindle machines the Hammond Radial Drilling and Tapping Machine may be spotted in the line for drilling, tapping or reaming. With its unique bracket type construction the spindle can be swung quickly from hole to hole without any intermediate adjustment. Six quick speed changes are instantly available and the Hammond tapping reverse is very fast and convenient to operate when there are a wide variety of sizes and depths of tapped holes.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

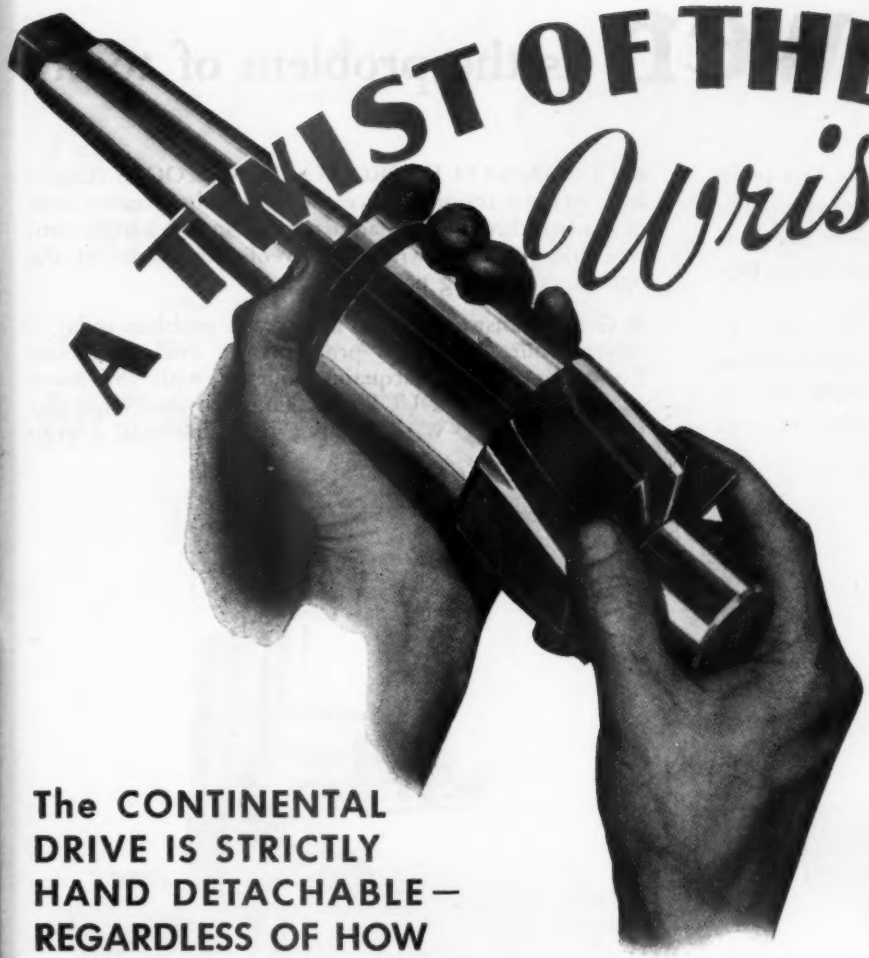
Detroit Office: General Motors Building

MOVE UP THE SCHEDULE ☆ WIN THE WAR QUICKER

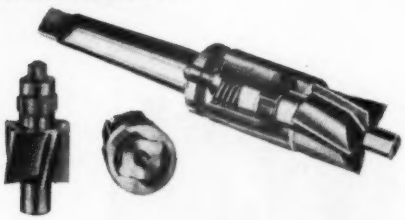
FOOTBURT-HAMMOND

Radial Drilling Machines

A TWIST OF THE *Wrist*



The CONTINENTAL DRIVE IS STRICTLY HAND DETACHABLE—REGARDLESS OF HOW SEVERE THE OPERATION HAS BEEN



With an ever-widening range of practical uses, the Continental Counterbore is proving a favorite standard cutting tool in all types and sizes of machine shops. Of rigid and simple construction, with patented features, it has long been outstanding in American industry. There's a reason: Note in illustration at left the Continental indestructible drive. It is composed of two driving lugs formed on the cutter shank, with two corresponding abutments on the inside of the holder. There is an aligning bearing above and below the driving lugs that brings the cutter and holder concentric, and prevents the cutter from being forced out of alignment. The cutter and holder are engaged and disengaged by revolving the cutter a quarter turn *by hand.* No tools or equipment are necessary.

CONTINENTAL TOOL WORKS

Division of Ex-Cell-O Corporation

DETROIT 6, MICHIGAN

CONTINENTAL TOOL WORKS

CTW

EX-CELL-O CORPORATION

Continental

CUTTING TOOLS

- Boring Bars and Tools
- Broaches
  Broach Pullers
  Broaching Fixtures
- Core Drills
- Counterbores and Countersinks
- CTW Drive Holders
- Counterbores (Tool Room Sets)
- Counterbore Pilots
- Inserted Blade Cutters
- Carbide Tipped Cutters
- Form Relieved Cutters
- Milling Cutters
- Thread Milling Cutters
- End Mills
- Side Mills
- High Speed Steel Reamers
- Carbide Tipped Reamers
- Shell Reamers
- Inverted Spotfacers
- High Speed Steel Tool Bits
- Carbide Tipped Tool Bits
- Circular Form Tools
- Cut-off Tools
- Flat Form Tools
- Dovetail Form Tools

45-46

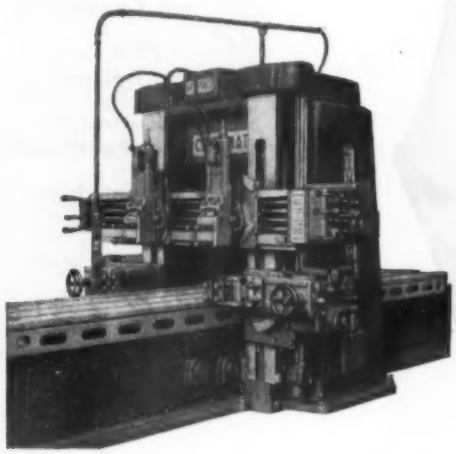
Manpower is the problem of today

● All users of machine tools can help solve this problem by replacing obsolete equipment. Our experience has been that in many cases one of our tools has done the work of two or three antiquated machines they replace.

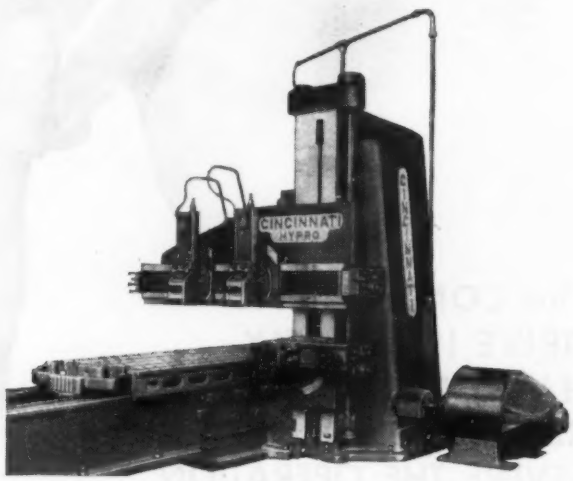
● A new CINCINNATI HYPRO will not only machine parts more quickly — it will produce work that is uniformly accurate—and increase production on your assembly line.

● CINCINNATI HYPRO MACHINE TOOLS require less operator training since they offer the greatest ease of control through fine adjustment handles, saddle control and pendant switches conveniently placed at the operator's working position.

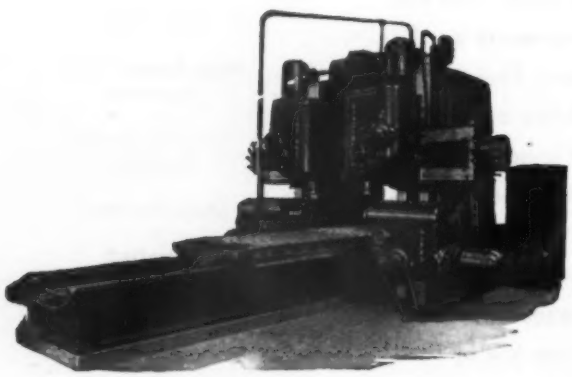
● Get the answer to your manpower problem today—submit your production problems for analysis to our Estimating Dept. — acquaint yourself with the many exclusive HYPRO-DUCTION features by writing today for Bulletin 153-W describing the Cincinnati Hypro Line.



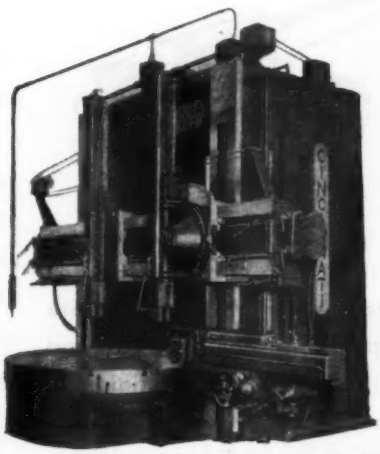
36" HYPRO DOUBLE HOUSING PLANER



48" HYPRO OPEN SIDE PLANER



HYPRO PLANER TYPE MILLING MACHINE



8' HYPRO VERTICAL BORING MILL

THE CINCINNATI PLANER COMPANY
Planers...Vertical Boring Mills...Planer Type Millers
CINCINNATI . OHIO . U.S.A.

Van Keuren simplified GEAR MEASURING SYSTEM

Set No. 26 Ex. Gear Measuring Wires

...provides GREATER ACCURACY... and SIMPLIFIED CALCULATIONS

Simple! . . . The only calculation required is one of simple division.

Reliable! . . . The system is based on formulas approved by the American Gear Manufacturers Association.

Accurate! . . . Van Keuren Gear Measuring Wires are accurate to within 25 millionths of an inch for roundness and exact size.

Van Keuren gear measuring tables give the measurements (M) over the wires (G) for 1 diametral pitch gears of correct pitch diameter (PD). The only calculation required is to divide the measurement for 1 diametral pitch by the diametral pitch of the gear being measured. The tables are complete for gears from 5 to 171 teeth and for pressure angles of 14½°, 17½°, 20°, 25° and 30°. The tables provide for measuring external, internal and helical gears. They are far more accurate than anything previously available and no interpolations are required.

ULTIMATE ACCURACY

Our Catalog No. 33 is a manual of precision measuring systems, giving complete tables and simplified formulas for measuring all standard threads, splines, gears, and worms. Send for this valuable handbook.

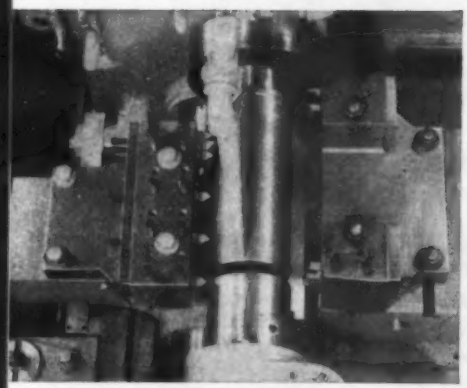
THE Van Keuren CO., 176 WALTHAM ST., WATERTOWN, MASS.

25th YEAR

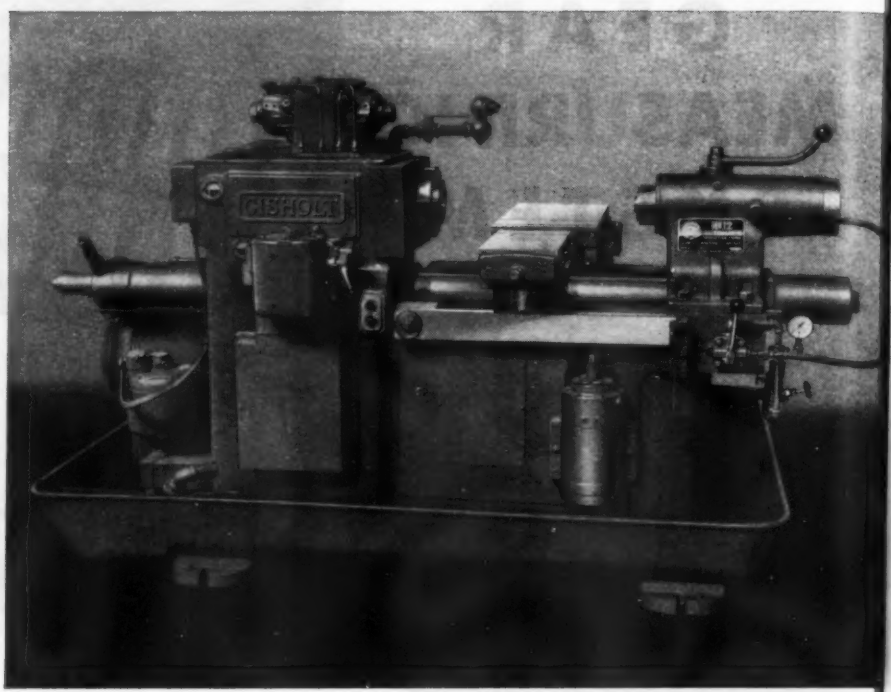
Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles.

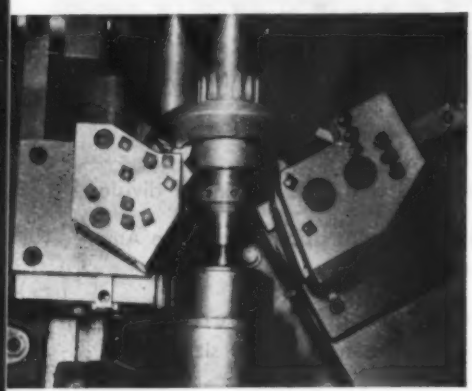
AN AUTOMATIC LATHE

can be versatile too!

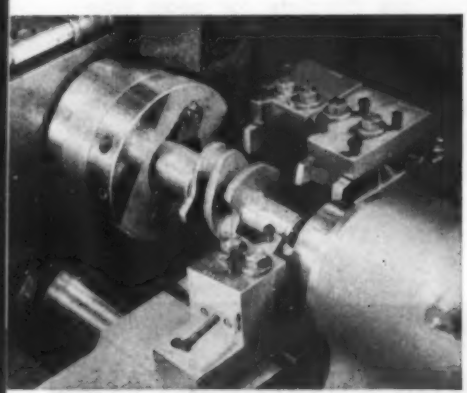


Machining Diesel cylinder liners. Automatic tool relief and fading out tool pressure at point of overlapping cuts, eliminates rings and grooves in the finished surface.





Bevel gears and other work having angular surfaces are machined without auxiliary slides, cams, taper attachments, etc., because rear slide can be set at any angle.



On crankshaft jobs like this, heavy turning and cheek facing with rough intermittent cuts are readily handled with real power and all-around rigidity.

THE GISHOLT NO. 12 HYDRAULIC *demonstrates it!*

On this modern automatic lathe, independent hydraulic feeds are provided for front carriage and rear slide, assuring smooth constant feeds with an infinite selection from ".000 to .060." Both slides are heavy and wide, permitting ample room for substantial multiple tool blocks.

On the front carriage, the top slide is equipped with micrometer dial and screw for easy adjustment of tools. Simple cam plates may be applied to the carriage support bar for special contour and taper turning. Rear slide may be set in any position for facing, turning or machining of angular surfaces.

Slides feed against and dwell at positive dead stops, insuring utmost precision. Elimination of feed gears, mechanical trips, cams, etc., greatly simplifies changes of set-up.

GISHOLT

GISHOLT MACHINE COMPANY

1201 E. Washington Ave. • Madison 3, Wisconsin

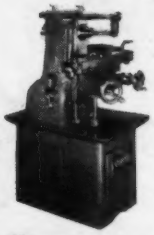
Look Ahead . . . Keep Ahead . . . With Gisholt Improvements in Metal Turning

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHIN

PRECISION LATHE

PRECISION TOOL ROOM LATHE

PRECISION SECOND OPERATION MACHINE



PRECISION MILLING MACHINE

MASTER COLLETS & FEED FINGERS WITH PADS

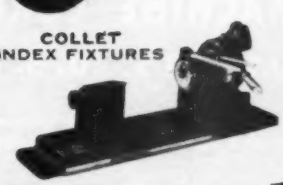
LATHE COLLETS

SCREW MACHINE COLLETS & FEED FINGERS

CIRCULAR FORM & CUT-OFF TOOLS

SPEED COLLET CHUCKS

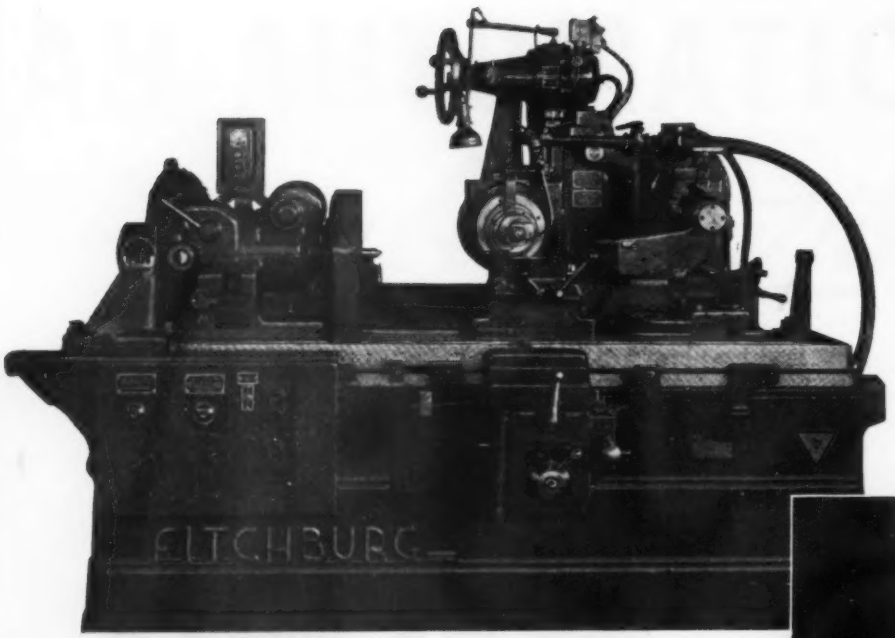
COLLET INDEX FIXTURES



A request on your company letterhead will bring you a copy of

this 16 page bulletin summarizing the profit making possibilities of each Hardinge precision product.

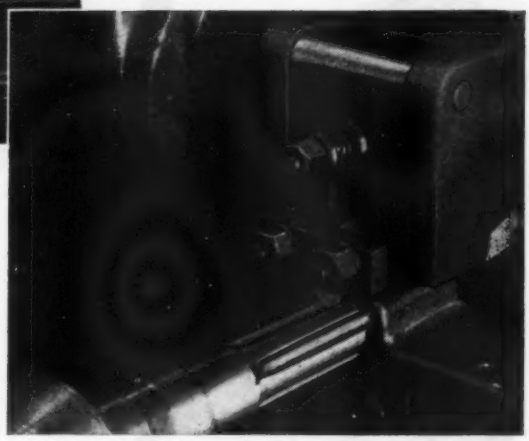
PERFORMANCE
has established leadership for HARDINGE ELMIRA, N.Y.



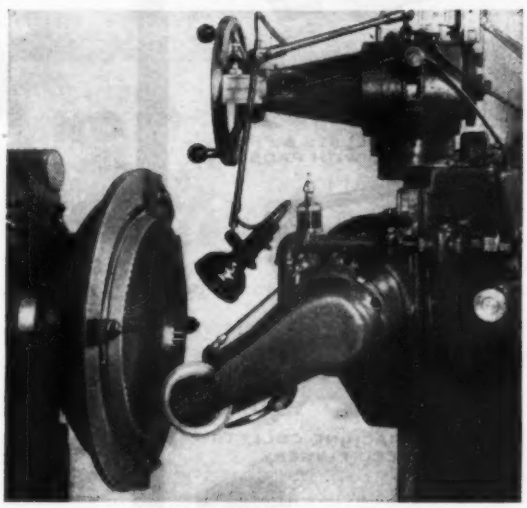
This book shows how to cut grinding costs . . . Sent free . . . write for it today.

SPLINE GRINDING?
SPLINE SHAPING?
INTERNAL GEAR GRINDING?
EXTERNAL GEAR GRINDING?

.... Do all four on the Fitchburg Gear Grinder



Spline Shaper Attachment



Internal Gear Grinding Attachment

A single Fitchburg Gear Grinder, with special attachments will

GRIND internal or external, helical or spur gears — straight, taper and helical splines, and will also

SHAPE straight, taper and helical splines.

A leading automobile manufacturing plant now engaged in making airplane engines, is using Fitchburg Gear Grinders with Special Wheelheads in the important operation of grinding internal gears. They give highest praise to its accuracy, fine finish and high production at low cost.

You can get the same results on a variety of work—on this one machine—why not let Fitchburg engineers show you how. Write today.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of—Bowgage Wheelhead Units. Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

Specify "NORTON RESINOID"

for Your Weld Grinding Jobs

Fast Cutting Action

Grinding wheels on portable grinders are not treated gently. They need abrasive grains that are strong and rugged as well as sharp. Laboratory control at the Norton electric furnace plant followed by special crushing and screening methods results in abrasives with the necessary chemical and physical characteristics. When used in a wheel of the proper grade (bond strength) for the job they combine fast cutting action with economical wheel life.

Smooth Cutting Action

Constantly improved resinoid bond formulae developed by the Norton research laboratories are such that under the heat of grinding the bond softens just enough to act as lubricant. Loading is decreased and the wheels have a smooth grinding action. And the resinoid bond has just enough resiliency to make the wheels hug the work and prevent bouncing.

A Norton abrasive engineer will specify just the right resinoid wheels for your weld grinding and other jobs with portable grinders.

NORTON COMPANY, WORCESTER 6, MASS.
Distributors in All Principal Cities

NORTON ABRASIVES

Motor Starters

TWO DEVICES IN ONE UNIT

INDUSTRIAL CONTROL

G.E. RECOMMENDS COMBINATION STARTERS because they HELP YOU SAVE 6 WAYS

1. 50% ***reduction in mounting time***—You mount only one device, not two.
2. 40% ***reduction in wiring time***—Connect to only 9 terminals, not 15. The switch and starter come already connected.
3. ***Increased safety***—Cover cannot be opened while there is power on the starter.
4. ***Conserve man power***—by eliminating one complete mounting job on every installation.
5. ***Saving of wall space***—The one device takes less space than two.
6. ***Save critical materials***—Combination starters require less wire and steel conduit and fewer fittings than separately mounted devices.

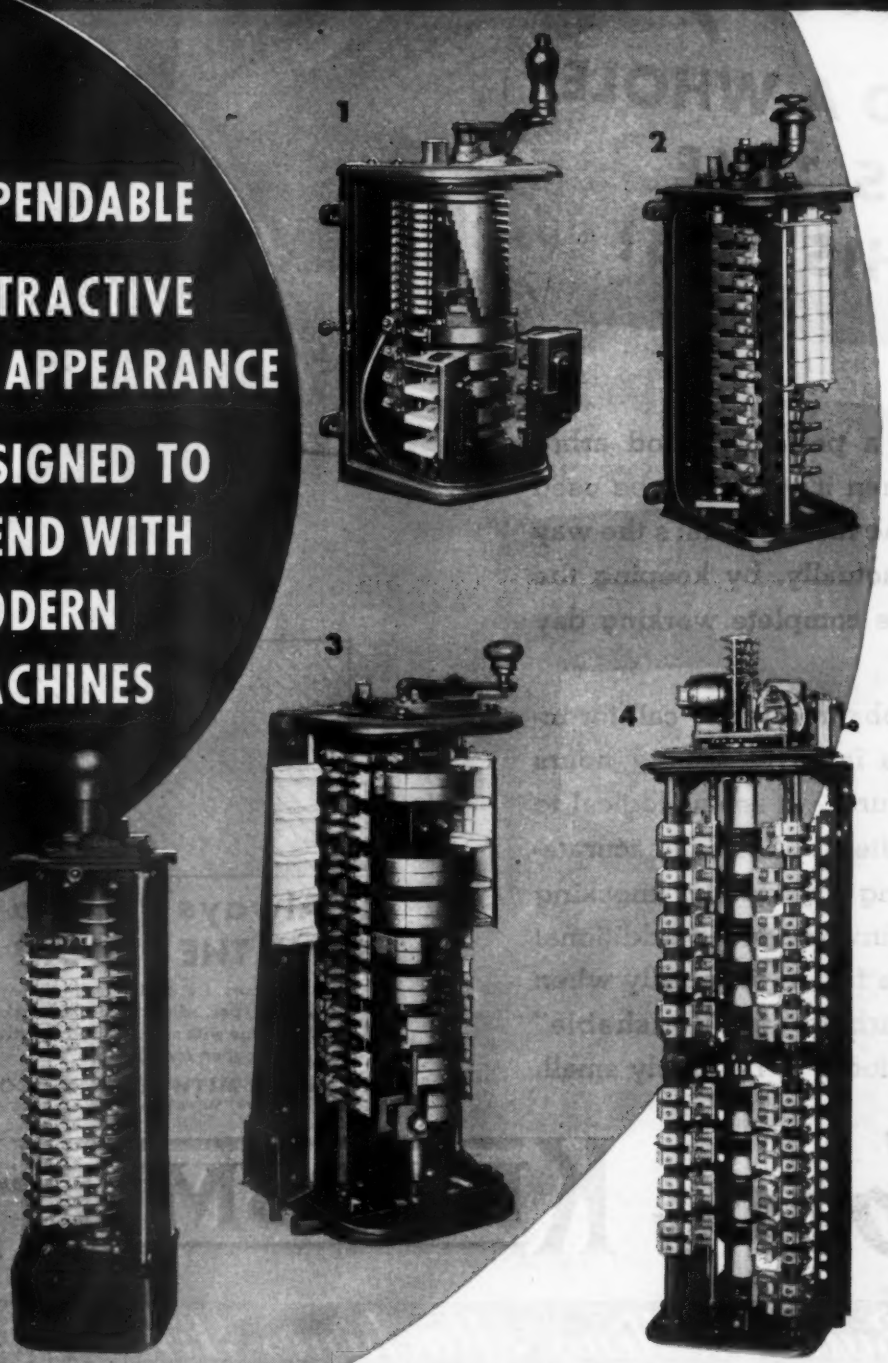
And remember, whatever your plant's operating conditions, you can get a combination control to fit it. This means a motor-circuit switch (with short-circuit protection) and a magnetic starter—in one, compact, easy-to-mount unit.

EVERY TYPE, EVERY SIZE, FOR EVERY MACHINE APPLICATION

★ DEPENDABLE

★ ATTRACTIVE IN APPEARANCE

★ DESIGNED TO BLEND WITH MODERN MACHINES



1. D-C DRUM SWITCH

For use with reversible or nonreversible d-c motors. Recommended where frequent motor-starting, stopping, and speed adjustment are necessary.

2. A-C CAM-TYPE DRUM SWITCH

Suitable for starting or reversing service on small cranes, hoists, machine tools, and similar applications. These drum switches (with primary resistance) will control squirrel-cage motors.

3. A-C REVERSING DRUM SWITCH

Designed for severe duty controlling large wound-rotor induction motors which operate cranes, hoists, bending rolls, etc.

4. MOTOR-OPERATED, A-C DRUM SWITCH

For secondary control of wound-rotor motors that have three-phase secondaries. Designed for either remote operation, or as an automatic control when used with a pilot-circuit device.

5. DRUM SWITCH FOR SMALL A-C MOTORS

Recommended for starting or reversing small wound-rotor motors—provides dependable operation.

NAME YOUR APPLICATION

Whether manual or magnetic controls are needed, our engineers are at your service and will be glad to assist you in selecting the correct starter for your application. Get in touch with your local G-E office, or write to us directly. *General Electric Company, Schenectady 5, N. Y.*

Buy all the BONDS you can—and keep all you buy

GENERAL ELECTRIC

676-128-8910

By Golly—

WE SAVED A WHOLE DAY'S TIME ON THIS JOB!

"Why knock down a perfectly good arbor and cutter set-up when it's going to be used again and again in the future? That's the way we figured it, and actually, by keeping the set-up, we saved one complete working day for every lot."

Production milling jobs frequently call for intricate cutter set-ups involving many hours of setting-up time. Surely, it seems logical to SAVE THE SET-UP after it has been accurately developed. Nothing is gained by knocking it down. The extra investment in additional arbors is a negligible factor, especially when you consider that arbors are "perishable" tools, and their cost today is relatively small.

It Always Pays to SAVE THE SET-UP!

Kempsmith Arbors are available in all popular sizes and types, adaptable to any make of milling machine with standardized spindle. *Mail coupon for literature.*

THE KEMPSMITH MACHINE CO.
1823 S. 71st Street, Milwaukee 14, Wis., U. S. A.

Arbors BY KEMPSMITH

Precision Built Milling Machines Since 1888

Write Today!

KEMPSMITH — Yes, I would like to receive a copy of your new Arbor Bulletin:

NAME ..... TITLE .....

FIRM ..... ADDRESS .....

A 4687-IP-C

"Put it on the Blanchard"

Get These Advantages

- Production ✓
- Adaptability
- Fixture Saving ✓
- Operation Saving
- Material Saving
- Fine Finish
- Flatness
- Close Limits ✓

.50 cal. Side Plates on No. 18 — 36" Chuck

These alloy steel plates are ground in three operations, first removing .015" stock from each side and then finish grinding the first side, removing .010" stock, to limits of ± .00075".

The 36" chuck affords ample area for chucking such rectangular pieces, about 2 feet long. The outer chuck ring is used to retain the pieces on the chuck and their area and thickness are such that no other blocking is needed.

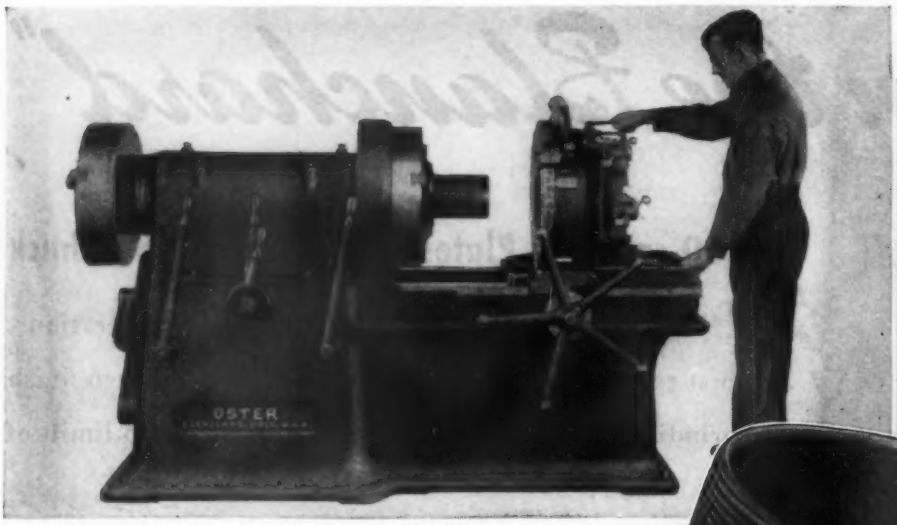
Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

This job being done on the No. 18 Blanchard Surface Grinder

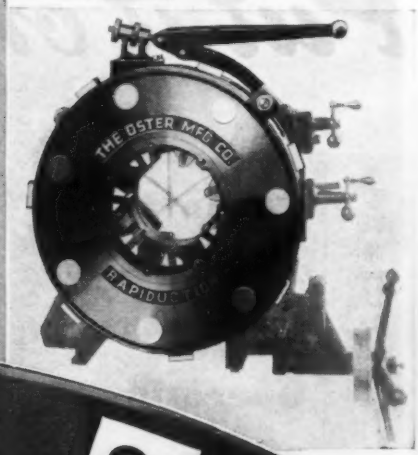
BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.



Oster "RAPIDUCTION" die-head adjusted to thread largest size of pipe within range of each machine.



One Die-Head

THREADS THEM ALL!

Movement of cam lever on the "RAPIDUCTION" die-head sets chasers for any size pipe to be threaded. Micrometer adjustment of lever sets chasers for any depth of thread desired.

Threading speeds of Oster "RAPIDUCTION" machines range from only 11.3 seconds on 1½" pipe to only 3 minutes, 10 seconds on the big 12" pipe. Those speeds are maintained on a continuous production basis.

Three Models

No. 6-A "RAPIDUCTION." Standard range 1½" to 6" pipe. Bolt range 1" to 4".

No. 8 "RAPIDUCTION." Standard range 2½" to 8" pipe.

No. 12 "RAPIDUCTION." Standard range 3½" to 12" pipe.

If you have large quantities of pipe to thread, Oster "RAPIDUCTION" machines will prove to be a profitable investment.

Oster "RAPIDUCTION" die-head adjusted to thread smallest size of pipe within range of each machine.

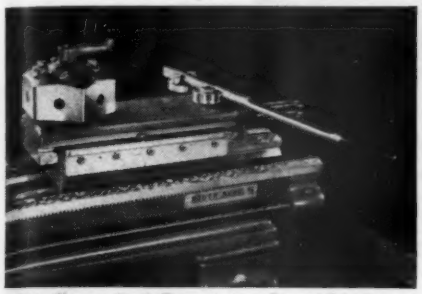
OSTER

"Rapiduction" PIPE MACHINES

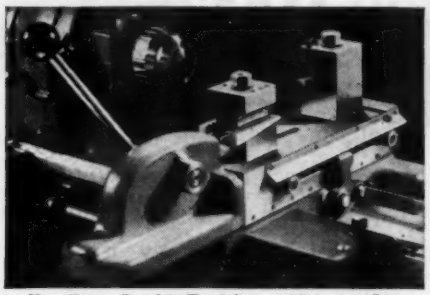
THE OSTER MANUFACTURING COMPANY, 2049 EAST 61st ST., CLEVELAND 3, OHIO, U. S. A.

MORE VERSATILITY

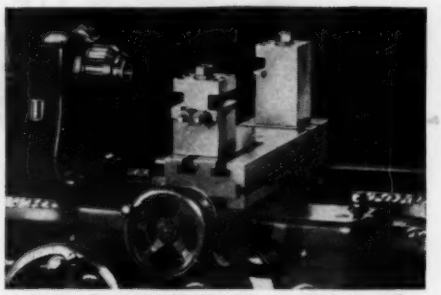
FROM SOUTH BEND LATHES WITH THESE ATTACHMENTS



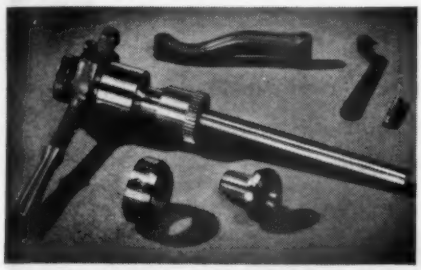
Handlever Bed Turret for 9" or 10" lathes multiplies their versatility through multiple tooling for repetitive operations.



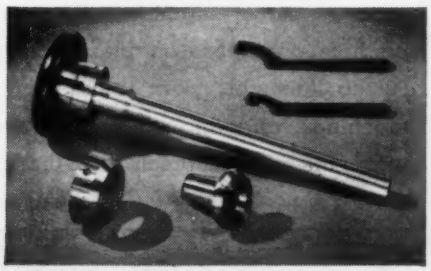
Handlever Double Tool Cross Slide for 9" or 10" lathes speeds up successive operations through the use of three cutting tools.



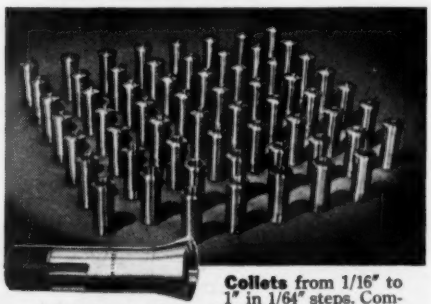
Screw Feed Double Tool Cross Slide for 16" lathes has both manual and power cross feed. Large graduated feed dial.



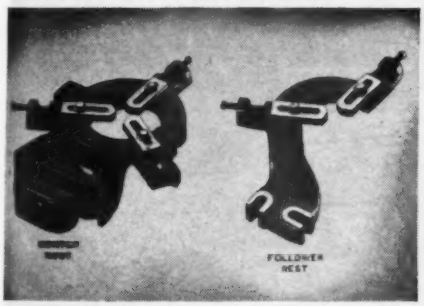
Handlever Draw-in Collet Attachment saves time on bar work. Collet can be operated and stock fed without stopping the spindle.



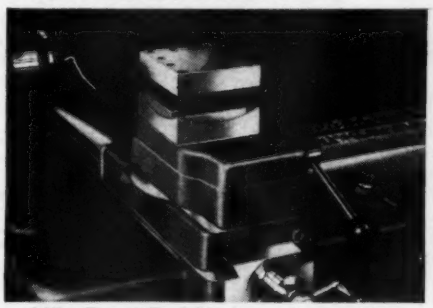
Handwheel Draw-in Collet Attachment is ideal for production and toolroom work that requires extremely close tolerances.



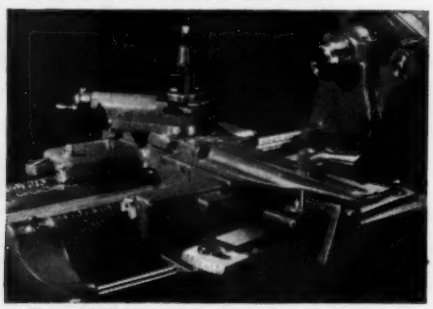
Collets from 1/16" to 1" in 1/64" steps. Complete sets of collets will save time.



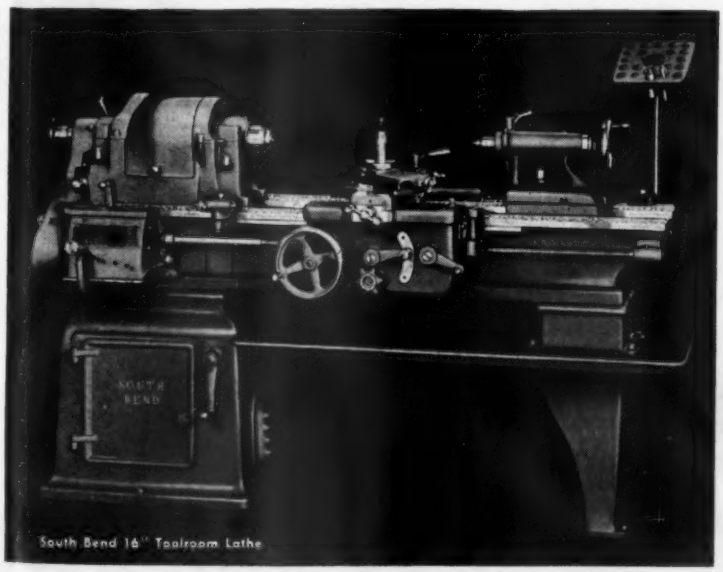
Center Rest and **Follower Rest** for supporting long bar work while turning, threading, drilling, boring, etc.



4-Way Turret Tool Block permits use of four cutting tools which simplifies tooling for repetitive operations.



Taper Attachment for accurate taper turning and boring. Quickly engaged. Graduated in in both degrees and taper per foot.



South Bend 16" Toolroom Lathe

These and other practical attachments greatly increase the capacity of South Bend Lathes for handling a wide variety of operations. They simplify difficult set-ups, save time and effort, and often eliminate delay and expense of making special fixtures.

Write for Catalog 77R in which all South Bend Attachments are illustrated and described. Also, state size and type of lathe required. These attachments are only available for use on South Bend Lathes.

BUY MORE WAR BONDS—SAVE FOR LATHES

SOUTH BEND LATHE WORKS

Lathe Builders for 38 Years

419 E. MADISON STREET, SOUTH BEND 22, INDIANA

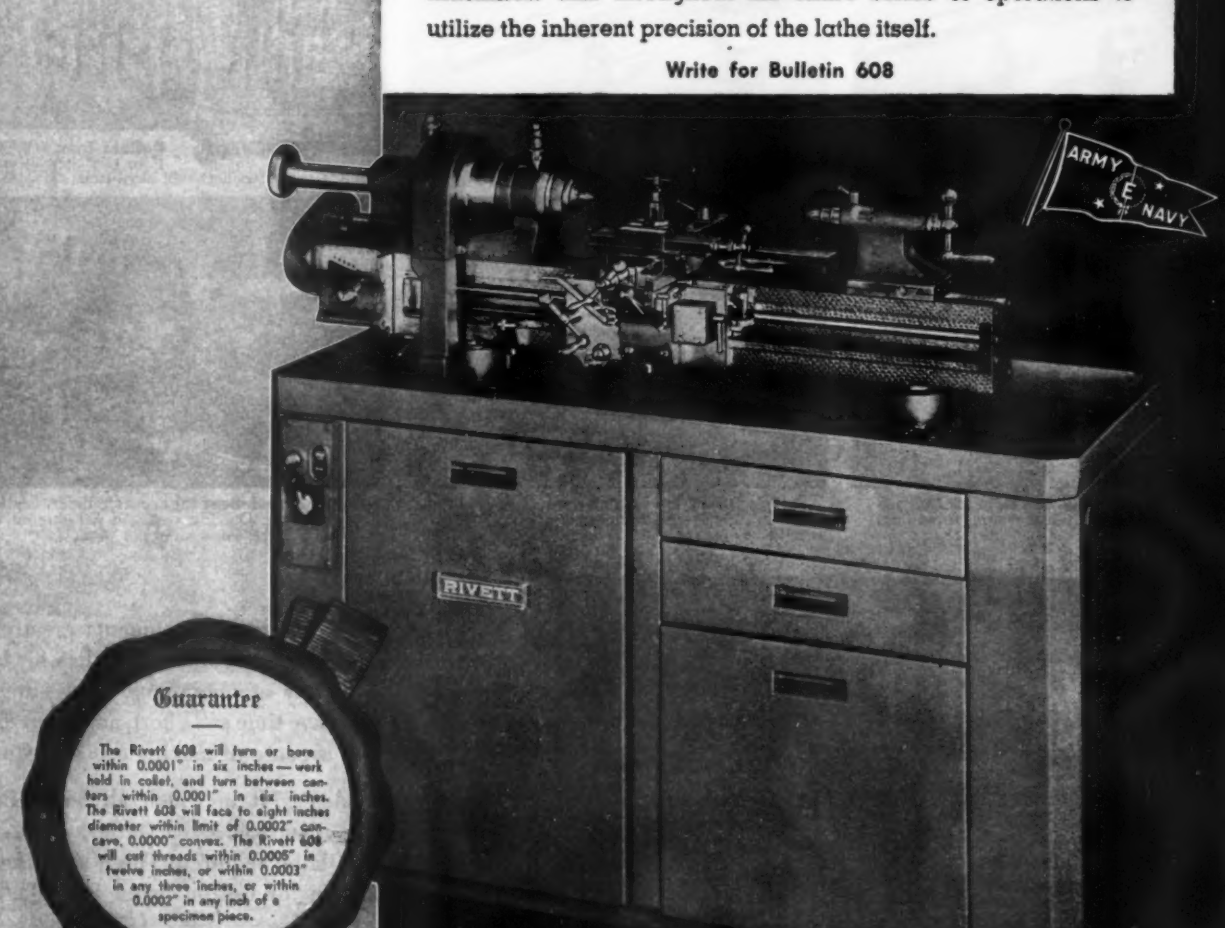
A ONE MACHINE TOOLROOM WITH GUARANTEED PRECISION

RIVETT

The Rivett No. 608 is a super-precision, back-geared screw-cutting bench lathe designed for fine manufacturing, repair and experimental work. In tool-making and instrument shops it will handle a great variety of parts within the closest precision limits.

Finely made attachments for milling, spiral cutting, slotting, relieving, taper turning, ball turning, grinding, forming and multiple operations enable the user of a fully equipped No. 608 to finish his work completely without recourse to other machines. and throughout his entire series of operations to utilize the inherent precision of the lathe itself.

Write for Bulletin 608

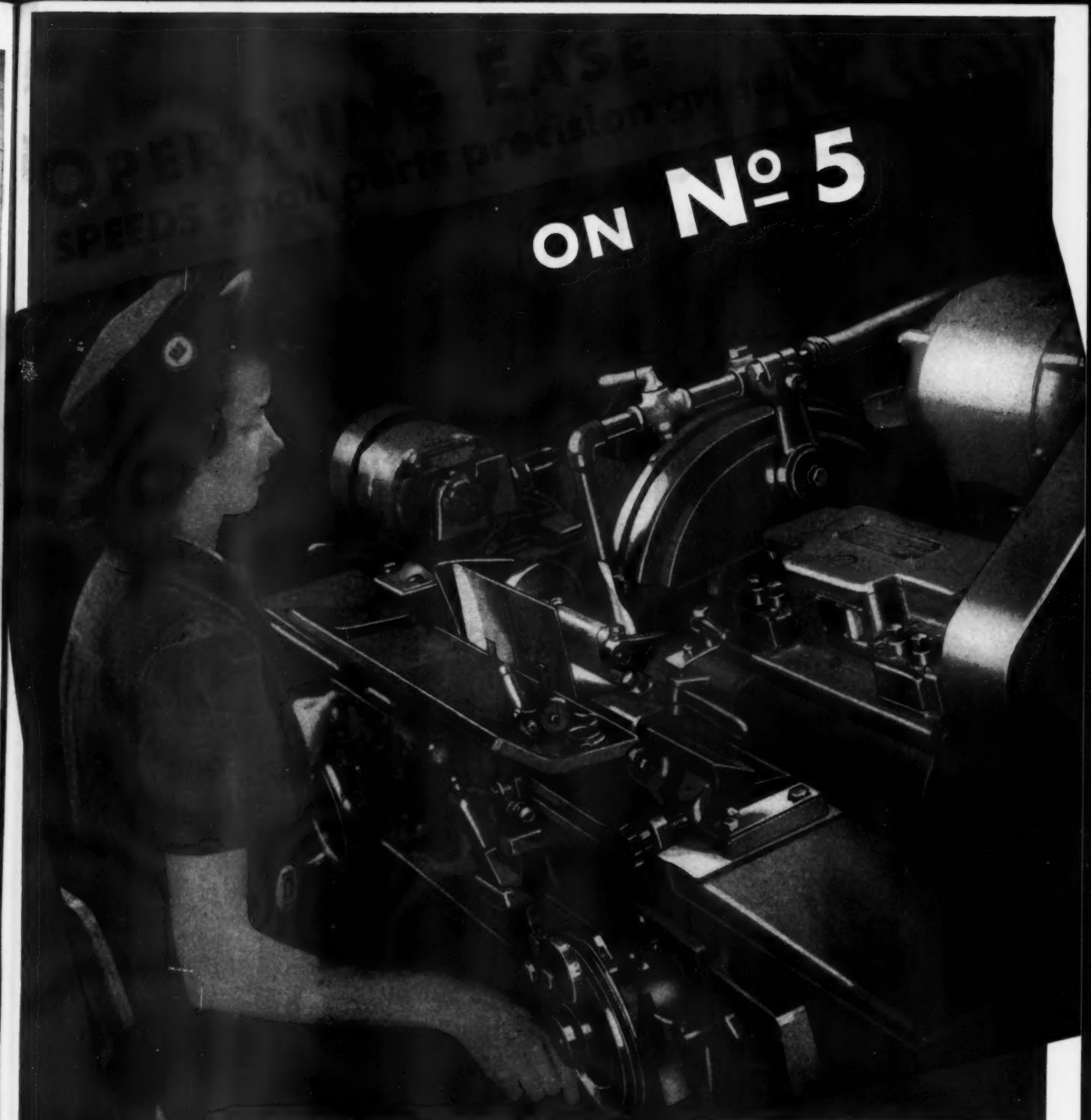


Guarantee

The Rivett 608 will turn or bore within 0.0001" in six inches — work held in collet, and turn between centers within 0.0001" in six inches. The Rivett 608 will face to eight inches diameter within limit of 0.0002" concave, 0.0000" convex. The Rivett 608 will cut threads within 0.0005" in twelve inches, or within 0.0003" in any three inches, or within 0.0002" in any inch of a specimen piece.

RIVETT LATHE & GRINDER INC.

BRIGHTON, BOSTON, MASS., U.S.A.



All controls grouped within convenient reach . . .
Recessed base permits operator to sit comfortably . .
Work loaded, ground and unloaded with minimum of motion, time and effort . . .
. . . and with the resultant *fast* production users get **high accuracy** — on many jobs to .0001" limit.

Investigate No. 5 Plain Grinding Machine's **profitable** features for your close-tolerance grinding of small cylindrical work.

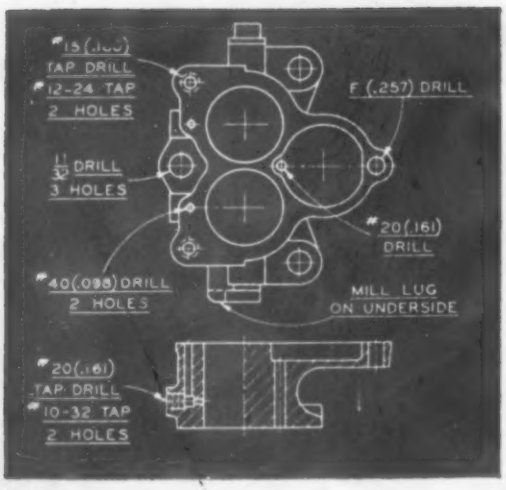
B·S **BROWN & SHARPE MFG. CO.**
Providence 1, R. I., U. S. A.

BROWN & SHARPE

FLEXIMATIC

The THRIFTY *Way*

To Solve Production Problems



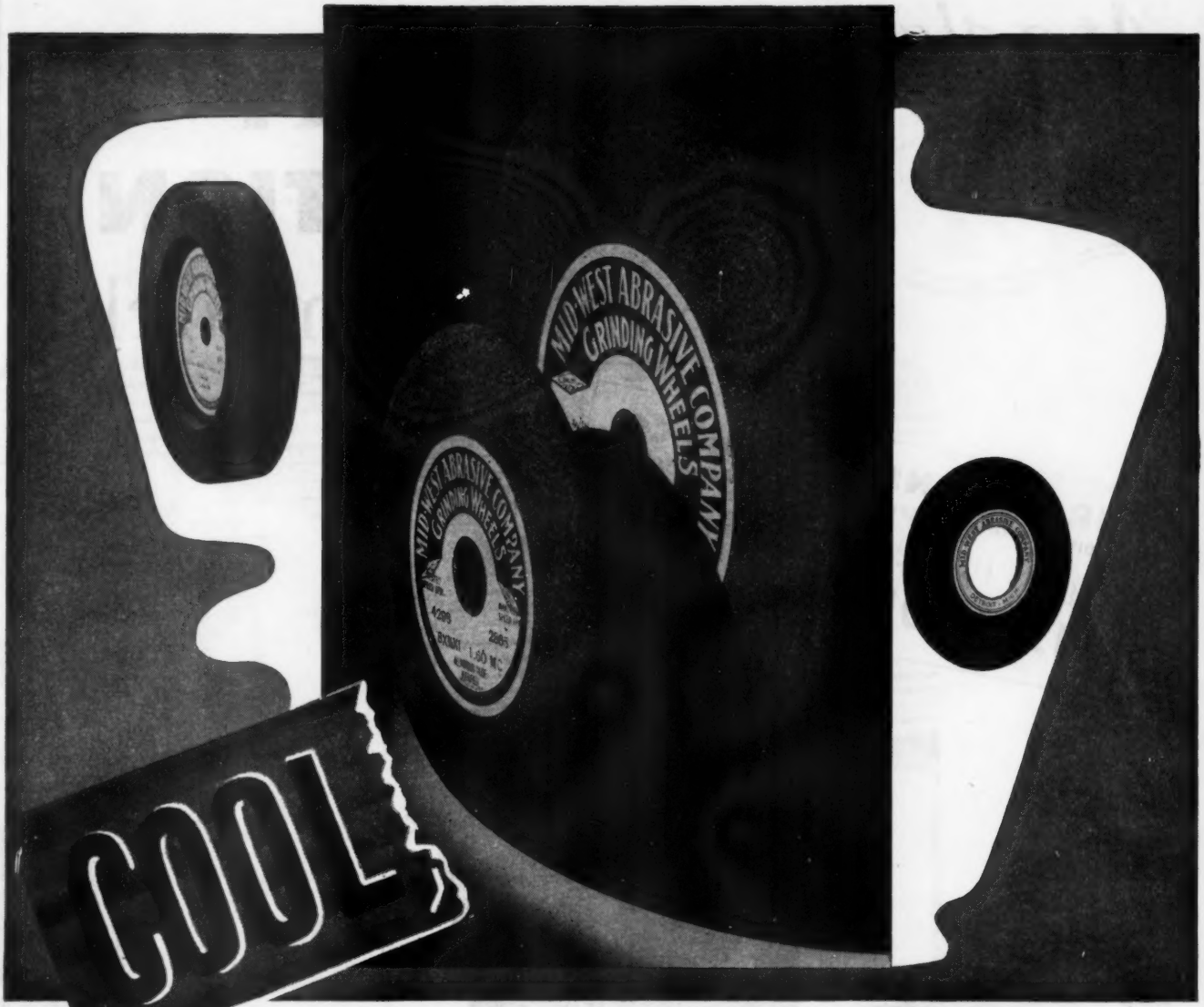
THIS IS A FLEXIMATIC JOB!

Over a dozen operations on the carburetor throttle valve bodies shown — and Kingsbury FLEXIMATICS perform the entire job in a single chucking of the work! An example of the thrifty way to solve multiple - operation production problems.

FLEXIMATICS are built up of standard Units, set up on a standard base around an automatically indexing work-holding turret. This unit system of construction keeps first costs low—out of the "special machine" class. And in addition, FLEXIMATIC Units can be changed, moved around and mounted in any combination on the base to meet the machining requirements of many different parts. That is why we say that **flexible automatic** FLEXIMATICS are the THRIFTY way to solve production problems.

KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U S A



Swift and Sure!

A grinding wheel that cuts cool at high rates of speed, producing amazingly fine tolerances, is only one of the many outstanding products of the Mid-West Abrasive Company.

Engineered quality is built into each of the many items in the broad Mid-West line of classifications—honing and sharpening stones, sandpapers, rubbing bricks, abrasive specialties or wheel dressers.

Let one of the Mid-West staff of experienced field engineers survey your abrasive needs and recommend the items to meet them.

MID-WEST ABRASIVE CO.

Manufacturers of DEPENDABLE Abrasives

Owosso, Mich. • 1960 E. Milwaukee, Detroit 11, Mich. • Rochester, Pa.

MAIL COUPON FOR FREE POCKET HONE

Mid-West Abrasive Co.
1960 E. Milwaukee Ave., Detroit 11, Michigan

Please send me your complete data book on grinding wheels.

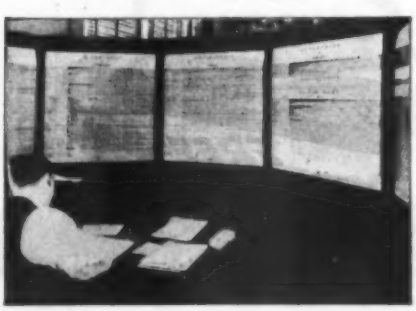
NAME_____

ADDRESS_____

At a glance... DELIVERY INFORMATION on 1½ million models!

BROWN INSTRUMENT CO.
A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.
gets immediate facts with
VISIBLE ORDER CONTROL

SCHED-U-GRAPH Sales Order Control Chart Boards show department capacity, over-all load and accomplishment to date by class and model. Graph-A-Matic signalling forms the *colored chart*. INDEX-VISIBLE index panels indicate "start" and "finish" of individual orders at six different stations. Comparison of two records provides dependable delivery data.



EXECUTIVE OFFICES contain a duplicate set of the Sched-U-Graph *Machine Load* Chart Boards, as used by Production Scheduling. Projected on three months' schedule, these facilitate over-all control.

Through a most ingenious use of Remington Rand visible record controls, the Brown Instrument Co. in Philadelphia (A Division of Minneapolis-Honeywell Regular Co.) is obtaining exceptional speed and accuracy in answering customer inquiries on the million and a half different instruments it produces.

Although this company's operations are highly complex, the joint use of *Sched-U-Graph* Production Charts and *Index-Visible* Sales Order Control Cards has contributed to a notable war-time performance.

On results, Mr. Paul R. Minich, Production Manager, says, "*Customers' telephone inquiries and letters are answered promptly, and we are maintaining schedules on a very high percentage of orders.*"

So successful has this installation proved that Brown officials have extended the use of Sched-U-Graph to the vital jobs of *Machine Load Control* and *Assembly Load Control.*

Full details of these record controls are in the February issue of "Systems". Ask our nearest Branch Office for a free copy.

SYSTEMS DIVISION

REMINGTON RAND

Buffalo 5, New York

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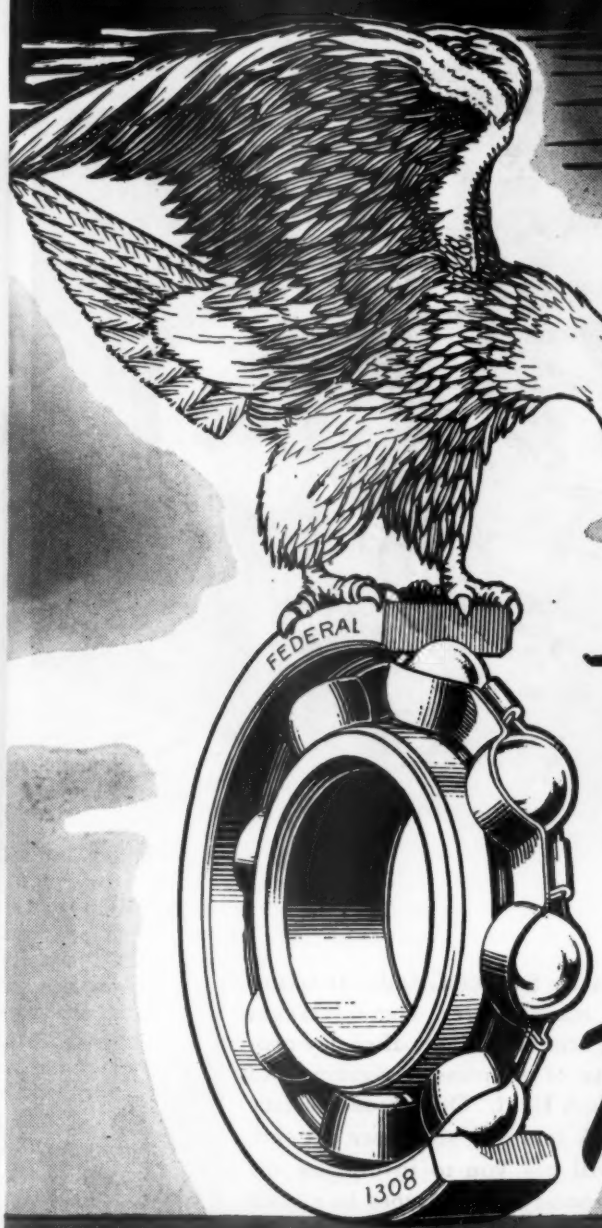
FEDERALS



for
EVERY
Ball Bearing
JOB

THE FEDERAL BEARINGS CO., INC.

Makers of Fine Ball Bearings

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REPRESENTATIVES LOCATED AT

Detroit: 2640 Book Tower—26 • Cleveland: 402 Swetland Building—15
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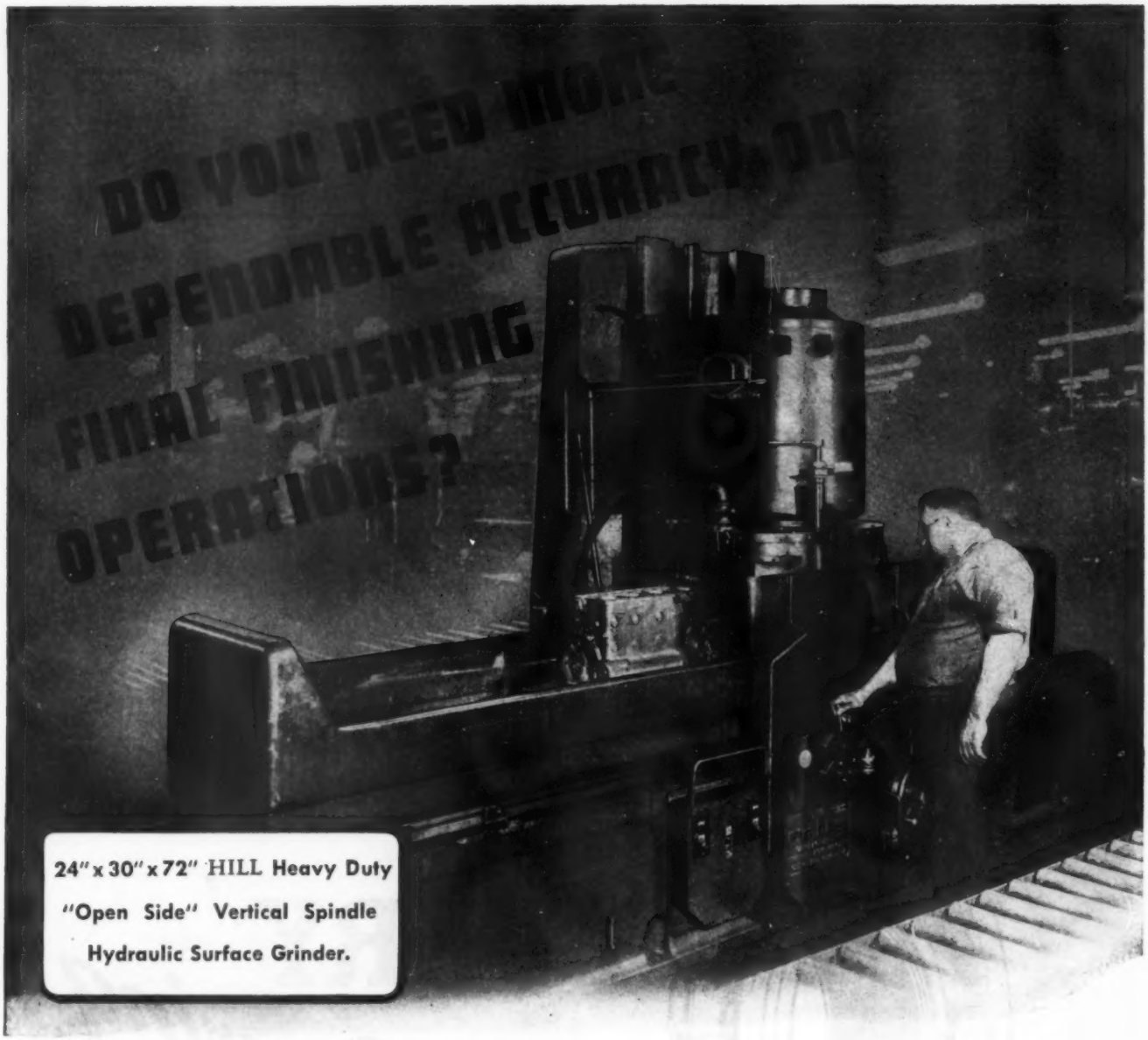


24" x 30" x 72" HILL Heavy Duty "Open Side" Vertical Spindle Hydraulic Surface Grinder.

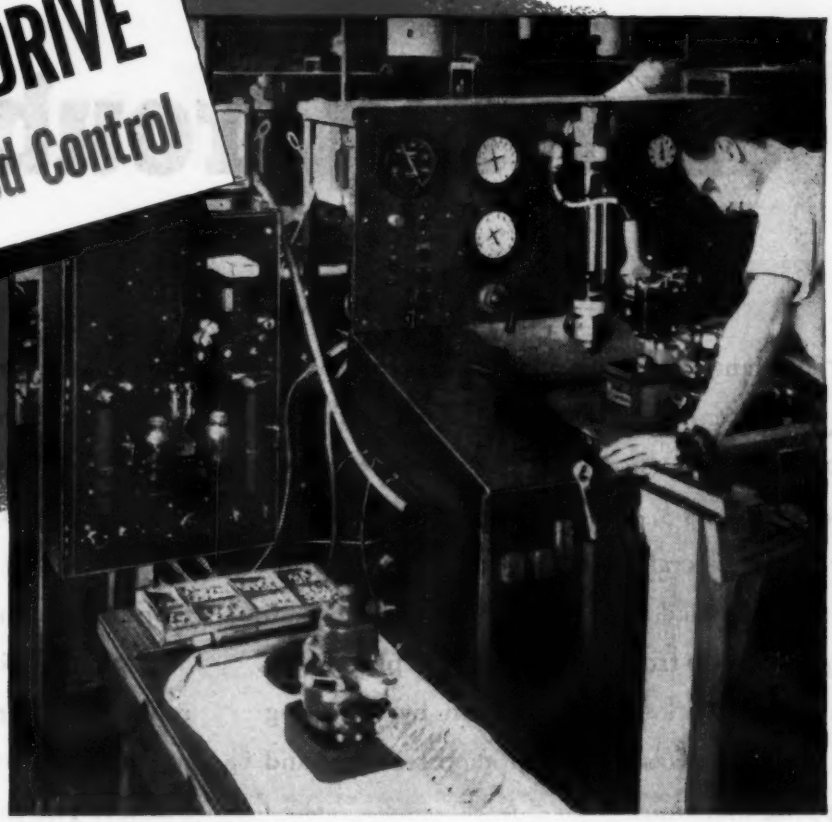
• This HILL "Open Side" Vertical Spindle Hydraulic Surface Grinder is facing motor blocks in the plant of a large mid-west manufacturer. Flat tolerances are being held to very close limits. Such grinding accuracy in day after day production operations is made doubly certain because of the massive rigidity, and smooth flow of hydraulic power, incorporated in each HILL "Open Side" Surface Grinder. • If you need greater production in stock removal, and more dependable accuracy on final finishing operations, it will pay you to investigate the HILL. • Built in both Vertical Spindle and Horizontal Spindle types in a wide range of sizes. Furnished with or without HILL Rectangular Magnetic Chucks.

The HILL ACME Co.

6400 BREAKWATER AVENUE • CLEVELAND 2, OHIO

ALSO MANUFACTURERS OF "ACME" FORGING, THREADING AND TAPPING MACHINES; "CANTON" ALLIGATOR SHEARS AND PORTABLE FLOOR CRANES

ELECTRONIC DRIVE with Stepless Speed Control



Thy-mo-trol electronic panel shown at left with cover removed

HELPS CHECK RPM to one "rev" in 3000

To test pitch-adjusting propeller governors to an accuracy within 1 rpm at maximum speed, Nash-Kelvinator Corporation needed second-splitting test stands far more precise than any conventional type available. Furthermore, the testers had to provide for measurement throughout the full range of rpm over which the governors were to operate.

In designing a new precision unit for the job, Nash-Kelvinator engineers required a motor drive which 1.) had the ability to maintain closely the required operating speed, 2.) provided wide speed range, and 3.) had a simple means of rapidly adjusting speed as desired. G-E Thy-mo-trol drive met all of these requirements.

Operated from a regular a-c power line, Thy-mo-trol furnishes smooth d-c motor torque to drive the governor at the desired speeds. The governor, in turn, controls a hydraulic system which simulates the pitch-adjusting mechanism of the propeller. The Thy-mo-trol drive is a "stand-in" for the propeller system. The Thy-mo-trol control circuit is tied into the hydraulic system so as to permit changing governor speed to duplicate the response of the propeller system, and thus provide a ground test of the governor.

Thy-mo-trol drive offers unusual advantages to designers of highly advanced machines, whether they be testers, machine tools, or special production devices, such as coil winders and welders. A single co-ordinated set of equipment furnishes *fully controllable* d-c motor torque from an a-c supply. Constant-current acceleration and constant speed under varying loads are inherent in the Thy-mo-trol system.

Standard Thy-mo-trol drives, including d-c motor, electronic panel, transformer, and control station, are available from ⅛ to 25 hp. G-E engineers will help you select and apply Thy-mo-trol drives or explore their suitability for new types of jobs. Ask for Bulletin GEA-4025. *General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

676-175-5B08

Buy all the BONDS you can—and keep all you buy

THY-MO-TROL DRIVE

Having trouble with

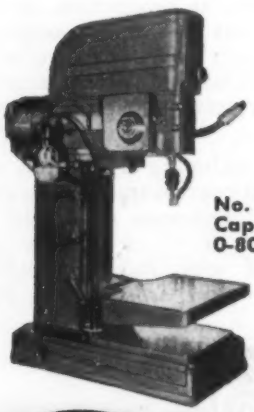
IN plant after plant at the beginning of the war, scrap piled up and production slowed down because usual equipment could not produce the class 3, 4 and 5 threads demanded for precision aircraft parts and other war material. If you have had trouble with precision threading, take a tip from the hundreds of plants who have since licked this problem by installing Warner & Swasey precision threading and tapping machines.

These machines were designed and built specifically for precision tapping of class 3, 4 and 5 fits in mass production quantities. Wherever they are installed, tap life multiplies, scrap percentages drop to the disappearing point, and overall production heads for the ceiling.

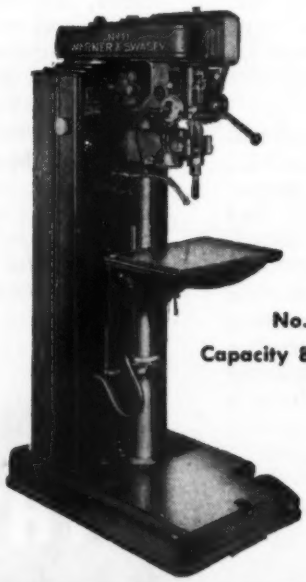
In a huge Naval Ordnance Plant, scrap loss runs 20 to 40% on conventional equipment. On a Warner & Swasey precision threading and tapping machine, the loss is 5%.

A famous mid-west manufacturer of tractors reports an increase in tap life from 46 pieces to 1140 pieces on switching to a Warner & Swasey. The job was a 1" 16-pitch thread.

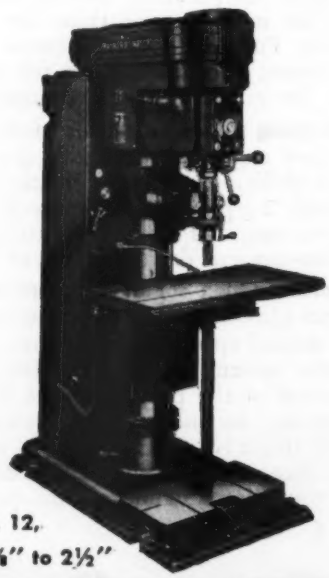
These are but two of scores of examples of what these machines are doing. Why not investigate now? Let a Warner & Swasey Field Engineer give you the complete story.



No. 10,
Capacity
0-80 to 10-24



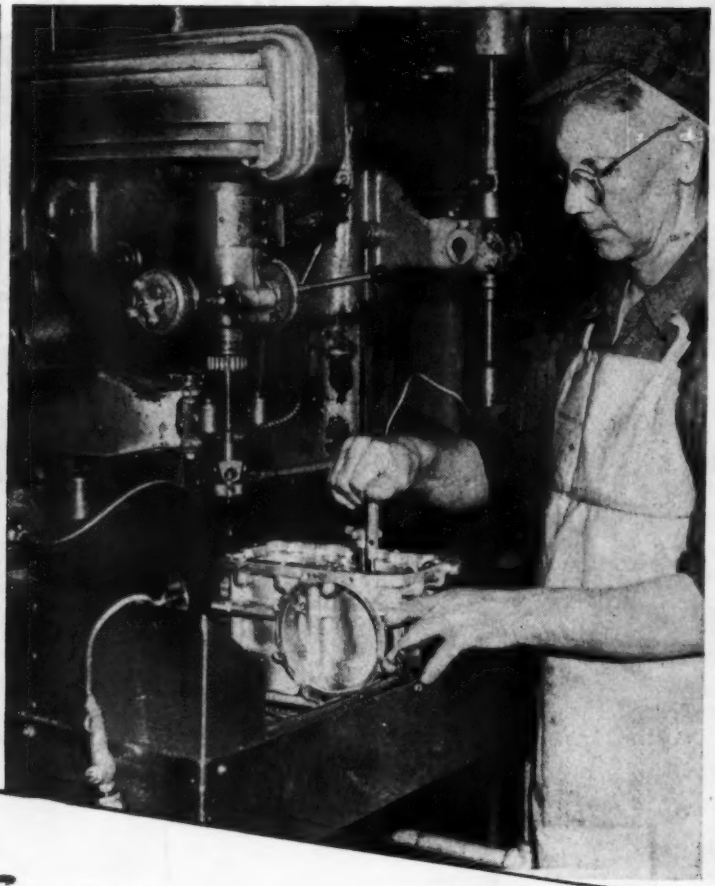
No. 11,
Capacity 8-36 to ⅞"



No. 12,
Capacity ⅝" to 2½"

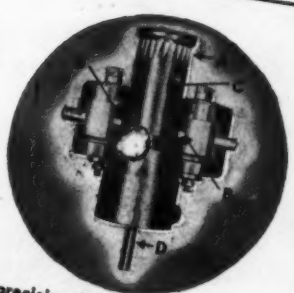
WARNER & SWASEY · CLEVELAND · OHIO

class 3 and 4 threads?



No. 11R,
Radial Capacity
8-36 to ⅞"

Secrets of this Success



A completely new and exclusive principle—the combination of lead screw and electrically actuated guide fingers guarantee tapping and threading accuracy. The upper portion of the lead screw (A) is a hob which cuts mating threads into the brass guide fingers (B) to match the pitch of the lead screw (C) and the tap (D). Solenoid action engages the guide fingers and lead screw to maintain precision lead during the tap travel. This patented mechanism compensates for wear of guide fingers against lead screws and eliminates lead errors and backlash.

An automatic safety clutch releases and stops the tapping operations if the tap becomes dull, hits a hard spot, or strikes chips in a blind hole. Figures show that this feature alone pays for the machine in increased tap life.

A super-sensitive depth control holds tap depths to 1/10 revolutions. Operator simply sets a dial to the depths wanted.

PUT IT ON A *Milwaukee*

TO MILL IT · · WITH SPEED · · PRECISION · · PROFIT

Milling Taper Reamer: in this operation a Milwaukee 3K Universal is milling the flutes in a 20° included angle taper reamer. A low lead attachment is used with a Milwaukee Model K Dividing Head and tailstock for driving, holding, and indexing the workpiece. The space between each flute is measured by less than one turn of the 5 to 1 ratio Milwaukee Dividing Head. A Milwaukee Style B Arbor employing both intermediate and outer arbor supports is used to hold the form cutter.

"When the job is a bit tricky — play it safe — put it on a Milwaukee" — that's what experienced machine-shop men say. The range — power — precision of Milwaukee Milling Machines — their versatility in handling a wide variety of intricate "precision" milling operations with the least time and trouble —has made them the preferred machines wherever metal is milled.

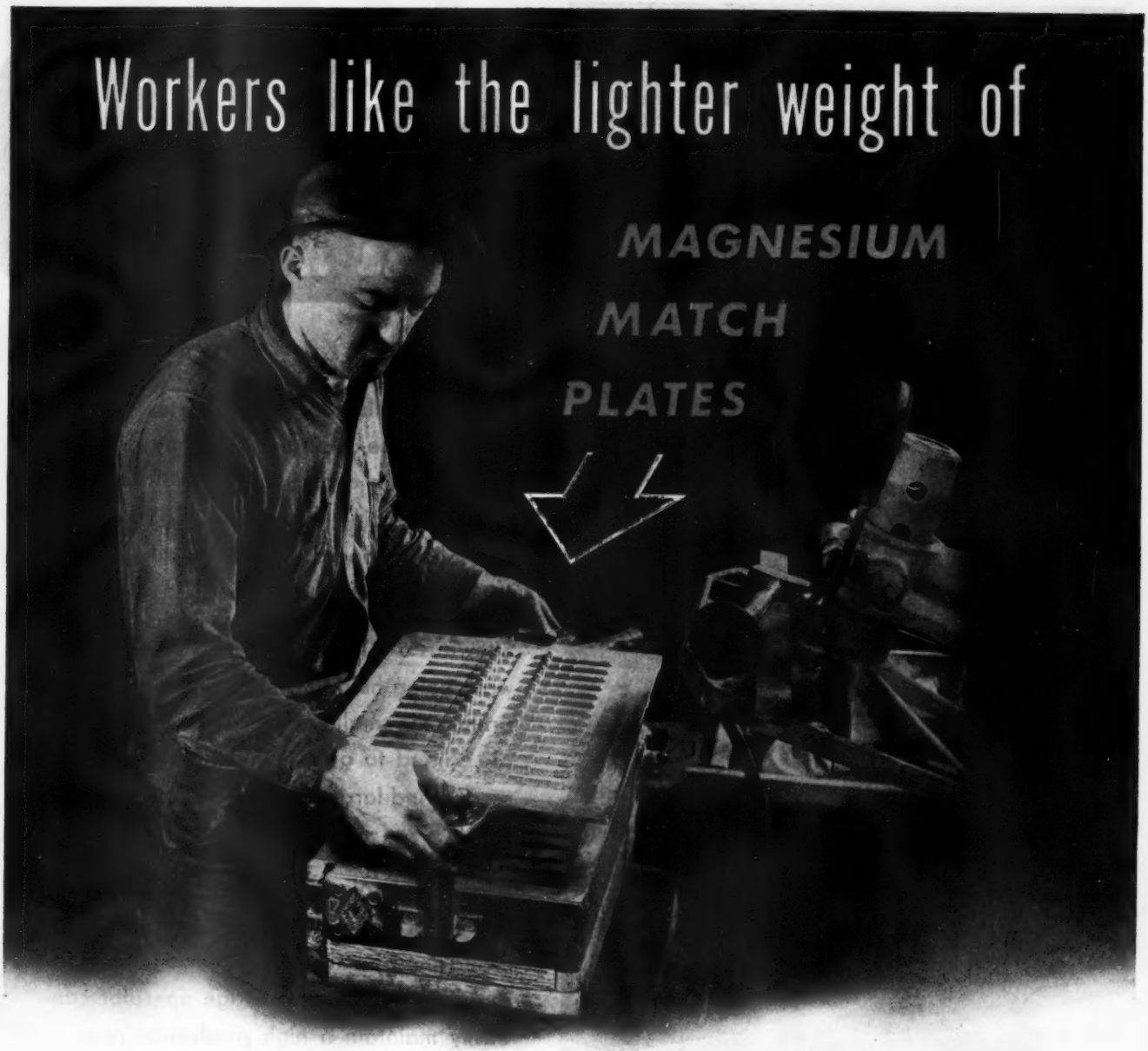
Write for complete information on the Milwaukee line of more than 70 models of milling machines.

KEARNEY & TRECKER CORPORATION

MILWAUKEE 14, WISCONSIN

Milwaukee Machine Tools

Workers like the lighter weight of



Mount your patterns on lightweight magnesium match plates and see how favorably your molders respond. Those pounds saved mean that less labor need be expended on useless lifting. The work is easier. There's less fatigue slump during the day.

Where magnesium is used in match plates, core boxes, and jigs and fixtures, weights are often held within legal limits for women workers. This simplifies your labor problems.

Let us help you determine how you can save time and money by employing lightweight Mazlo Magnesium Alloys. Aluminum Company of America, Sales Agent for American Magnesium products, 1709 Gulf Building, Pittsburgh 19, Pa.

MAGNESIUM MAZLO PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

FOSDICK *High Speed* DRILLS

● Batteries of these FOSDICK High Speed Sensitive Drills are in use throughout the nation. In use as single units and arranged in gangs with a common table—these machines are doing a lot of drilling, reaming and tapping operations rapidly and with a minimum of cost.

Shown is a FOSDICK Model 5 BM—drilling work being held in a simple fixture. After drilling the small hole, the fixture and work are shifted to a second machine where a second and larger hole is drilled.

FOSDICK High Speed Drillers have a wide range of spindle speeds—have ample power for drilling steel as well as cast iron —and may be furnished with either hand or power feed. An average operator can easily maintain a high production rate.

Where versatility and high production are required on holes up to 1½" diameter, investigate the FOSDICK High Speed Drill. Complete details are available in our High Speed Drill Bulletin HSA.

Write for yours.

ARMY E NAVY

FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, ··· OHIO

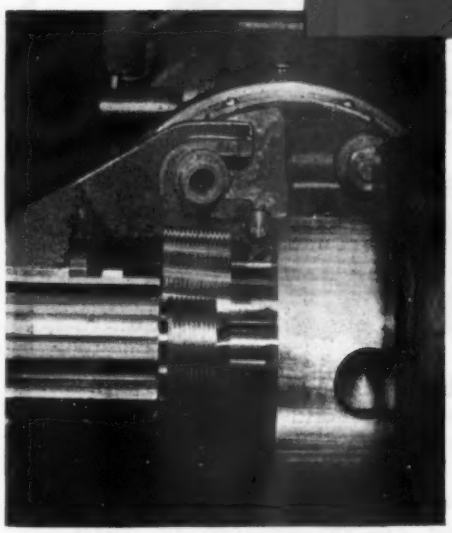
BARBER-COLMAN

HOBS • HOBBING MACHINES • HOB SHARPENING MACHINES • MILLING CUTTERS
REAMERS • REAMER SHARPENING MACHINES • SPECIAL TOOLS

UNGROUND

THREAD MILLING CUTTER HOLDS CLASS III LIMITS IN VERY TOUGH MATERIAL

100 PIECES PER SHARPENING!



Barber-Colman UNGROUND Thread Mills are exceptionally accurate, in spite of the fact that the tooth profiles are not ground after hardening. This fact is achieved through specialized production methods, particularly in the heat-treatment, used by Barber-Colman to maintain specified cutter dimensions. A typical example of cutter results is shown, on which 12-pitch threads, 1¼" diameter by 1" long, are milled to Class III limits on a production basis. The material is heat-treated NE 9445 steel with a Rockwell C hardness of 33-37. Surface speed of cutters is 105 feet per min., with a feed of 3.28" per min. giving a floor-to-floor production time of 5 minutes per piece. Pitch diameter is held within .0015". Even in this tough material these UNGROUND cutters produce 100 pieces per sharpening. *Investigate Barber-Colman UNGROUND Cutters for your production jobs!* Write for Copy of Facts About Multiple Thread Milling Cutters.

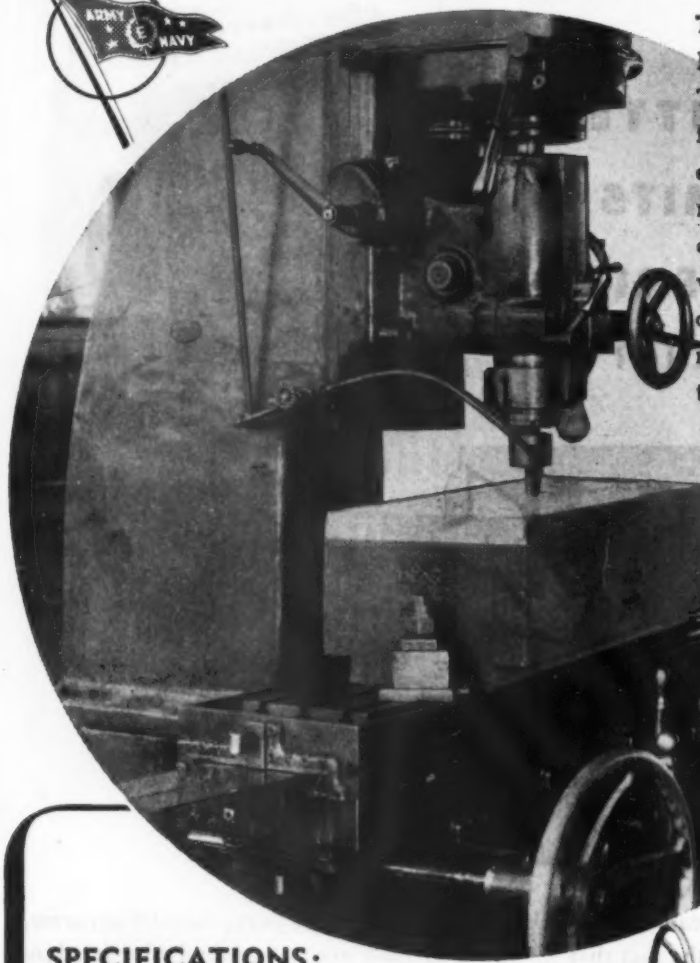
Barber-Colman Company

GENERAL OFFICES AND PLANT 111 LOOMIS ST., ROCKFORD, ILLINOIS

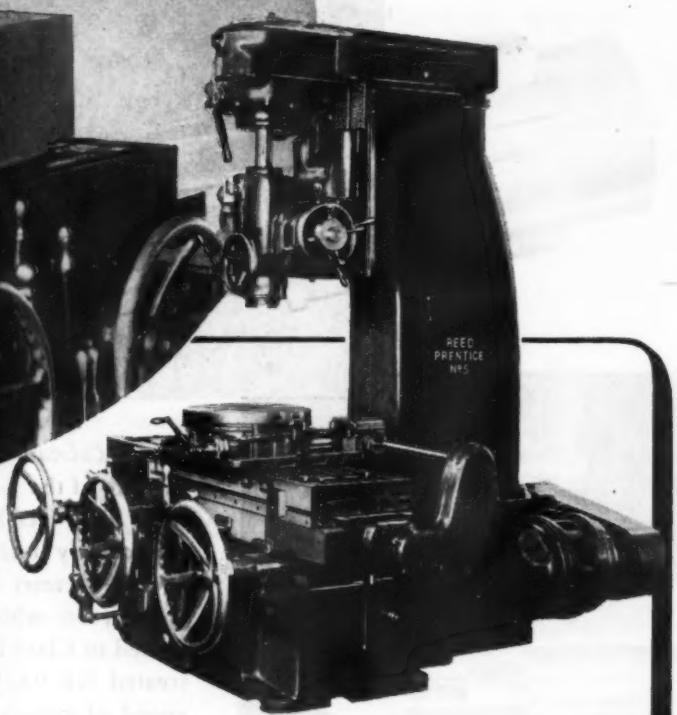
FOR IMMEDIATE DELIVERY ... WITHOUT PRIORITY!

A limited number of Reed-Prentice #5 Die Sinkers and Vertical Milling Machines are available for immediate delivery—without priority.

REED-PRENTICE #5 DIE SINKER AND VERTICAL MILLER



This sturdy machine is of rugged construction — built to last! Completely equipped with 70 Timken bearings. The saddle supports the table full length. Rapid power traverse of the table, either cross or longitudinal, at the rate of 100" per minute, speeds the work on intermittant cutting of large pieces. Centralized control of all levers, within easy reach of the operator at the front of the machine, reduces man-power fatigue to a minimum. This die sinker is particularly adapted to the making of drop forging dies.



SPECIFICATIONS:

Longitudinal power feed	48"
Cross power feed	16"
Vertical adjustment head on column	15"
Vertical feed of spindle	9"
Table, working surface	68" x 16"
18 Spindle speeds	17-600 R. P. M.
Maximum distance, end of spindle to table	30"
Throat depth	20"
Rapid Power Traverse—either direction—longitudinal and cross (per minute)	100"
Weight	11,500 lbs.

Also available as an all around, efficient, vertical miller — fast and accurate — for general milling work.

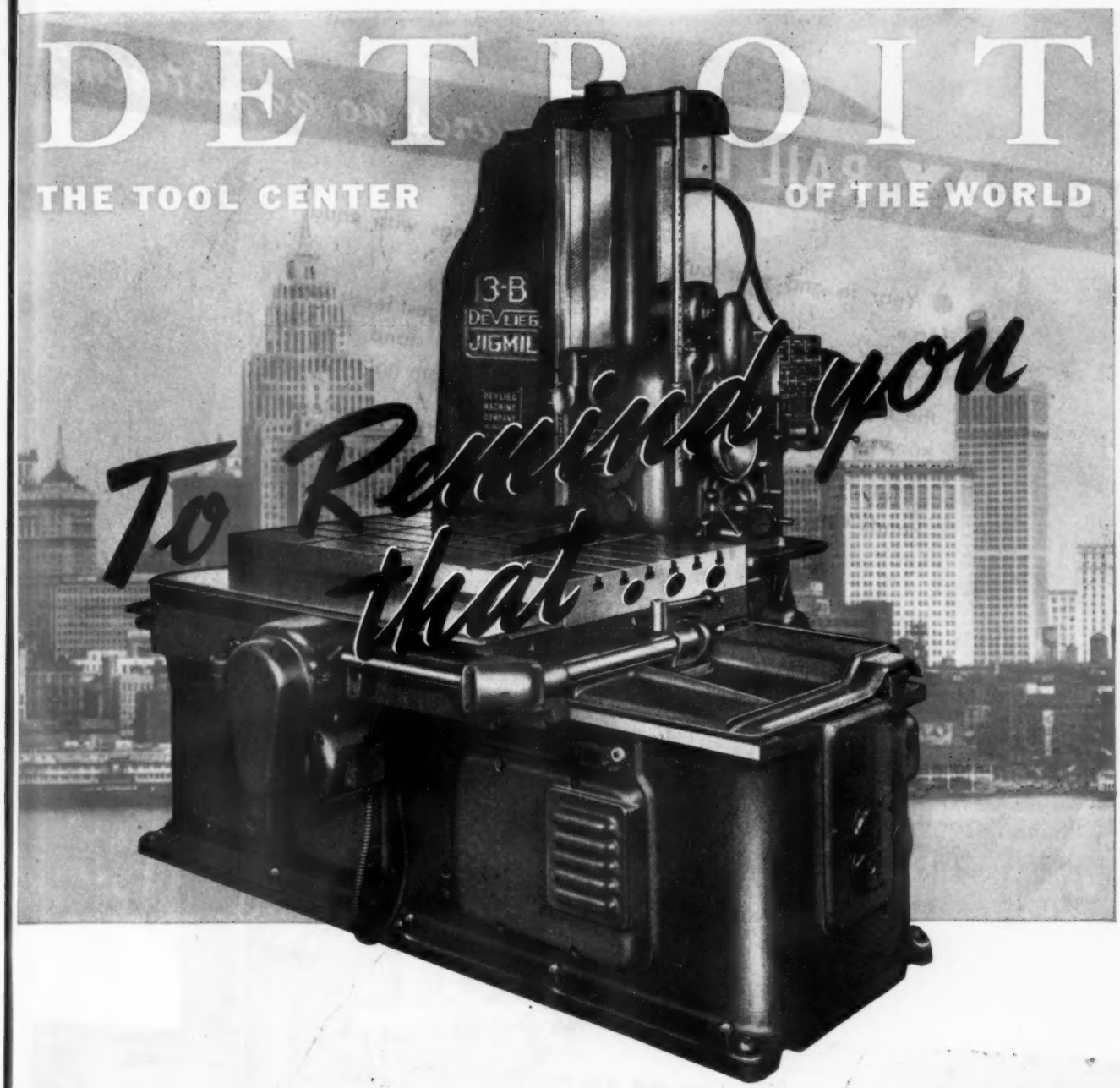
MACHINE TOOLS

REED-PRENTICE CORP.

WORCESTER MASS., U.S.A.

BECAUSE OF THE LIMITED NUMBER OF THESE MACHINES AVAILABLE, ORDERS WILL BE FILLED ONLY AS RECEIVED. ORDER NOW TO INSURE IMMEDIATE DELIVERY.

NEW YORK OFFICE: 75 West St., NewYork 6, N. Y.
CLEVELAND OFFICE: 1213 W. 3rd. St., Cleveland 13, Ohio



The World's Finest BORING and Milling Machine is made in Detroit

On June 17th we received the Army-Navy white star for continued excellence

This new Model 3-B JIGMIL has automatic power means to position the spindle from one location to another accurately to within much less than .0001 (one-ten-thousandths part of an inch). Thus, extreme laboratory accuracy is conveniently available with ordinary skill that would normally make such precision very high in cost. This, and many other refinements, go further to prove that the JIGMIL Idea is a totally new approach to the problems of precision boring at a new low cost.

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

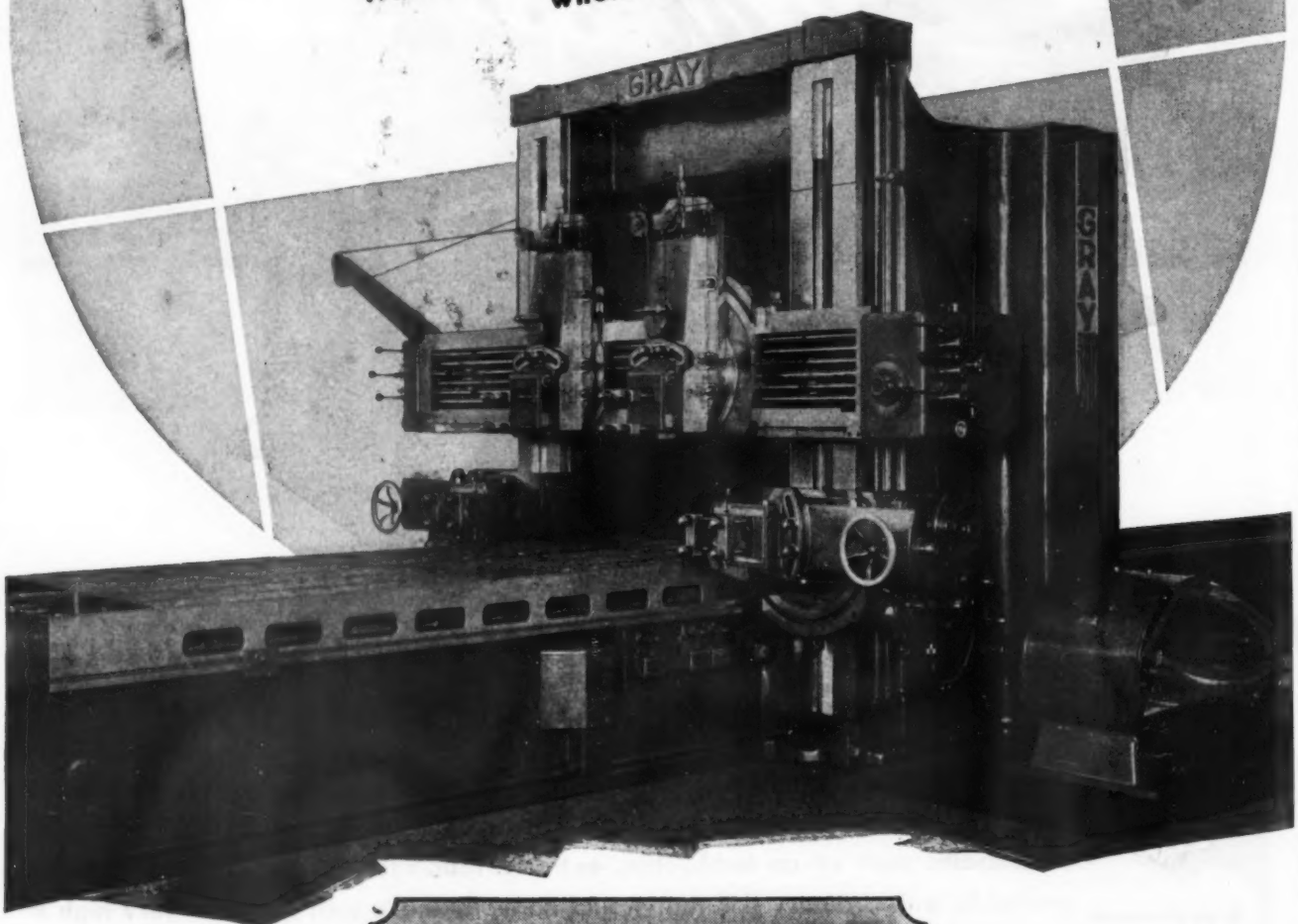
GRAY RAIL LOCK *requires no adjustment.*

● Year in and year out it grips both housings with equal force.

The operator of a Gray Planer can use the largest feeds and the highest speeds that the work and tools will stand, for he knows that his rail is always rigidly locked to both housings.

This is only one of the many features that give Gray planer hands confidence in their machines.

Write for bulletin 40-R. It tells the whole story.

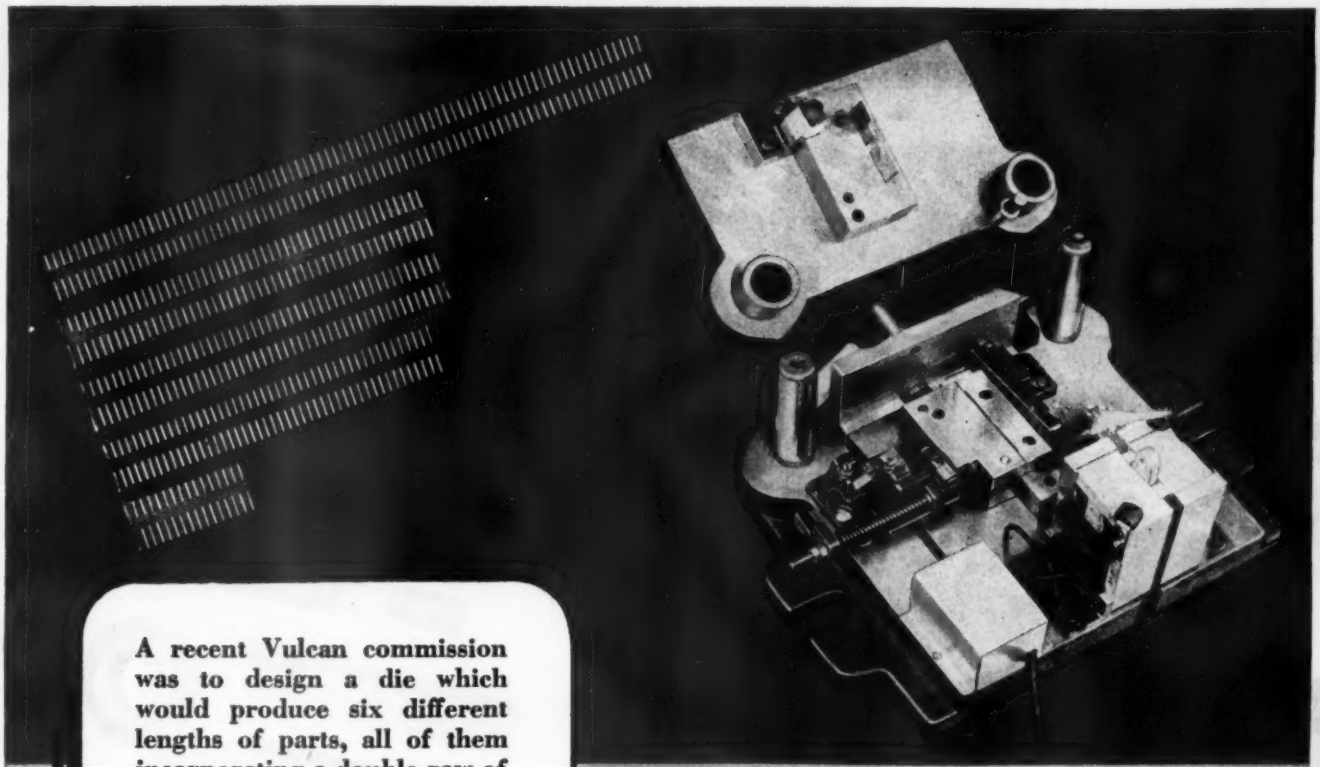


GRAY

THE G. A. COMPANY

Cincinnati 7 Ohio, U. S. A.

THE GRAY LINE — Double Housing and Openside Planers, Switch Planers, Die Block Planers, Double-Housing and Openside Milling Planers, Planer Type Milling Machines, Horizontal Boring Machines.



A recent Vulcan commission was to design a die which would produce six different lengths of parts, all of them incorporating a double row of slots spaced 0.156 in. on centers. The number of slots in the various pieces ranged from 17 to 84. So that one tool could be used for the production of all parts required, the die was fitted with a change-gear indexing device, which trips a relay after the required number of slots have been cut. Thereupon, a push-down solenoid core actuates a cut-off blade.

Let's take an example

What company puts a touch of cleverness into tools which makes them so speedy and accurate that they give the purchaser a special manufacturing advantage?

Perhaps the question is best answered by showing the above example. Vulcan special tools will fit *your* special needs as the die illustrated so happily fits the needs of the radio manufacturer who delegated its designing to Vulcan.

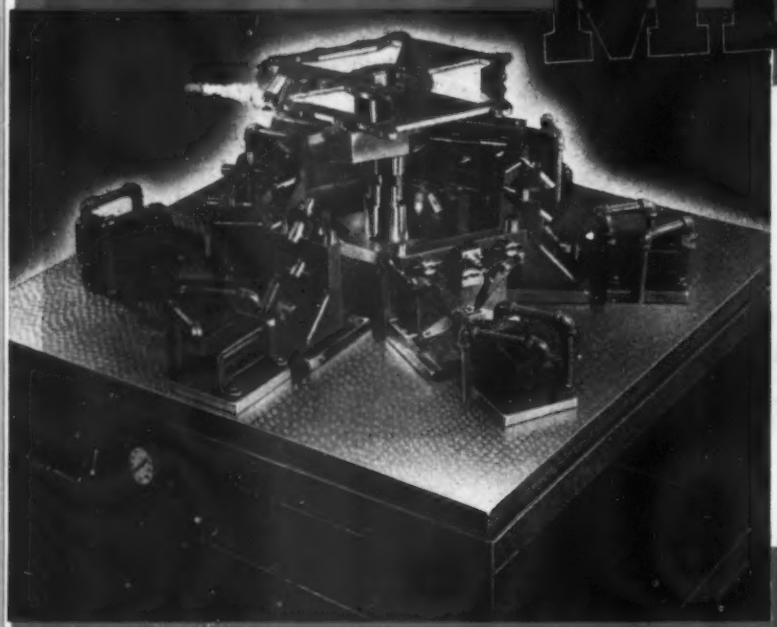
ASK FOR THE BROCHURE

The VULCAN TOOL *Co.*

213 NORTH BECKEL STREET DAYTON 3 OHIO

ENGINEERING • PROCESSING • DESIGNING • BUILDING
TOOLS • DIES • JIGS • GAUGES • SPECIAL MACHINERY

Everybody knows METRO



METRO CARBIDE TIPPED TOOLS AND METRO GAGES

are well-known to American industry, either through use or reputation. Proved through peacetime production . . . doubly proved by the higher tempo and greater requirements of wartime production, Metro Gages and Carbide Tipped Tools are in a position to be doubly approved both by the men on the production line and by the dealers who supply them in the postwar years. Ask us, too, about special tools and gages for special jobs. Metro engineers will design them for you or make them up from your specifications.

ARMY E NAVY

Metro Standard Gages and Carbide Tipped Tools are available through your Metro distributor. Send for free catalog.

METRO TOOL AND GAGE CO.

4240 Peterson Avenue
Chicago 30, Illinois

Sidney Lathes
in service with the Navy long before Pearl Harbor

Official U. S. Navy Photograph

● Below deck on a "battle wagon" there is also plenty of action. The machine shop has a job to do in keeping the guns and equipment in the fighting trim.

Here on the Iowa Sidney Lathes are being used to turn out parts essential to the maintenance of the battleship. This is only one of a number of prominent battleships now using Sidney Lathes.

The four wall bed construction with heavy cross sections—the continuous tooth herringbone geared head providing a smooth flow of power—the centralized controls that make for easier operation are points of design that make for dependable accuracy and greater production.

They are points insuring precision work whether the lathe is on land in a production shop or at sea on a battleship.

Bulletins on all models available

The SIDNEY MACHINE TOOL COMPANY
Builders of Precision Machinery
SIDNEY • OHIO
ESTABLISHED 1904

Staining? Foaming?..
We've found the cutting oil that licks them!

WATCH PRODUCTION STEP UP . . . REJECTS DWINDLE . . . WHEN YOU SWITCH TO 875 MARATHON C-16 CUTTING OIL

Think you *have* to put up with staining and foaming in a cutting oil? You *don't*. Not since Ohio Oil research engineers went to work, came up with 875 Marathon C-16 Cutting Oil.

Now you can use a cutting oil that not only eliminates these two enemies of efficient production . . . but that also assures finer finish, longer tool life, lower temperature operation and higher cutting speeds.

Sounds like a big order for a cutting oil? It is. And Marathon C-16 fills it. Get complete facts. Write or wire. Ask an Ohio Oil lubrication engineer to call.

A complete line of stainless, foamless cutting and grinding oils for every requirement.

ON AUTOMATIC SCREW MACHINES USE 875 MARATHON C-16 IN GEAR BOXES, TOO

Leakage between gear boxes and cutting fluid then cannot impair the efficiency of the cutting fluid. In addition to its acceptance as a cutting oil, Marathon C-16 is widely used as a lubricating oil in gear boxes. Performing the dual function of a lubricant and a circulating oil, Marathon C-16 protects against damage to tools resulting from dilution of cutting oil with gear box lubricant.

MARATHON

THE OHIO OIL CO.

GENERAL OFFICES: Findlay, Ohio • DISTRICT OFFICES: Robinson, Ill., Indianapolis, Ind., Louisville, Ky.

PRODUCERS OF PETROLEUM SINCE 1887

"This stuff's pretty fussy . . . give it to a shop with Pratt & Whitney Equipment"

It stands to reason that, all other things being equal, *the better equipped a tool shop is, the better it can satisfy you on quality and accuracy.*

The manufacturer who buys tools, dies, jigs, fixtures, and other precision equipment from a shop using Pratt & Whitney machine tools, small tools, and gages can expect just that much more quality and precision in anything they make for him.

And the chances are that Pratt & Whitney equipment will not only do the job better, but do it *faster.*

This is a tip worth heeding . . . whether you need new tools now, or for reconversion later on. For 85 years wise manufacturers have proved to their own satisfaction that the name Pratt & Whitney stands for accuracy and dependability second to none.

Typical of the many P&W machine tools found in any well-equipped shop is this Jig Borer — one of the finest precision machines ever built. Designed specifically for the particular job of precision boring, this machine also can be used as a "jig eliminator" on small lot precision manufacturing. Write for full information on this and other Pratt & Whitney toolroom equipment.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1 • CONNECTICUT

Thompson Grinders

meet close tolerance demands in grinding precision aircraft parts

● Here is a typical shot of a Thompson Type C. Surface Grinder grinding aircraft parts to close tolerances. The machine is shown grinding outside diameter of pin bosses including blending radii.

The hydraulically driven fixture operates off the main hydraulic circuit of the machine causing the fixture to index in adjustable increments at each table reverse.

Just another example of the flexibility of Thompson Grinders in meeting specific requirements of the job and turning out a smooth finished accurate job.

On your surface grinding work, for the ultimate in accuracy and smooth finish put your jobs on a Thompson Hydraulic Grinder.

Our catalog contains complete, detailed information. Write for one.

THE Thompson GRINDER CO.

EXCELLENT CHARACTERISTICS OF SHAVED GEARS

Can be Preserved in Hardening

Gear tooth hardness need no longer be a compromise between machinability and wear resistance. Red Ring Rotary Gear Shaving as the final machining operation on the green gear, during which approximately .001″ of stock is removed from the tooth surfaces, corrects cutting errors of index, helical angle, tooth profile, eccentricity and undesirable tooth roughness.

This corrected gear may then be induction hardened to whatever surface hardness is desired and without objectionable distortion. Hardening without detrimental distortion is frequently accomplished on gears carburized after shaving by quenching in dies and sometimes by liquid carburizing and quenching without dies. No grinding of tooth profile is necessary.

On a 5.145″ P.D. gear so treated, final involute error is held to between +.00015″ and —.00015″; parallelism to .0002″; tooth spacing to .0001″ to .0002″; and accumulated error to .0008″.

WRITE FOR DESCRIPTIVE FOLDER ON RED RING GEAR SHAVING

Specialists on **SPUR AND HELICAL INVOLUTE GEAR PRACTICE**

Originators of **ROTARY SHAVING AND ELLIPTOID TOOTH FORMS**

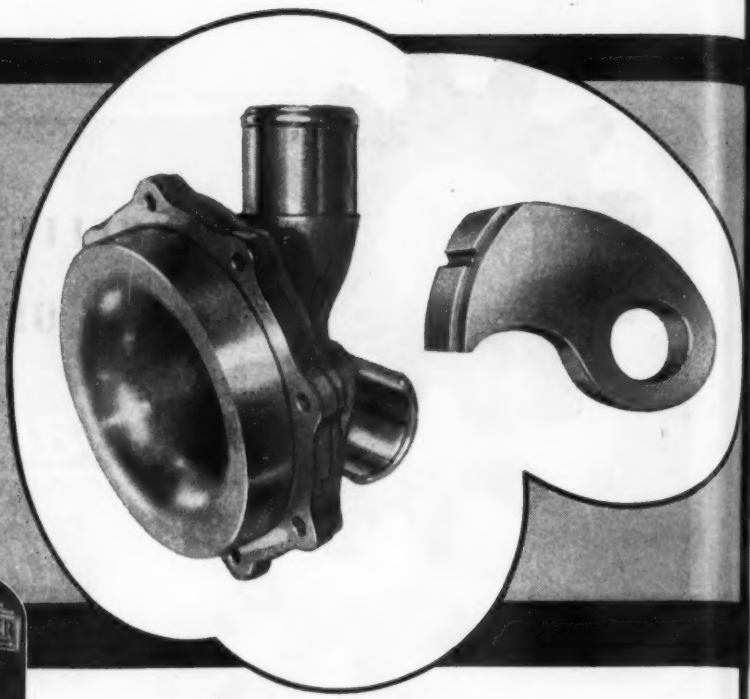
NATIONAL BROACH AND MACHINE CO.

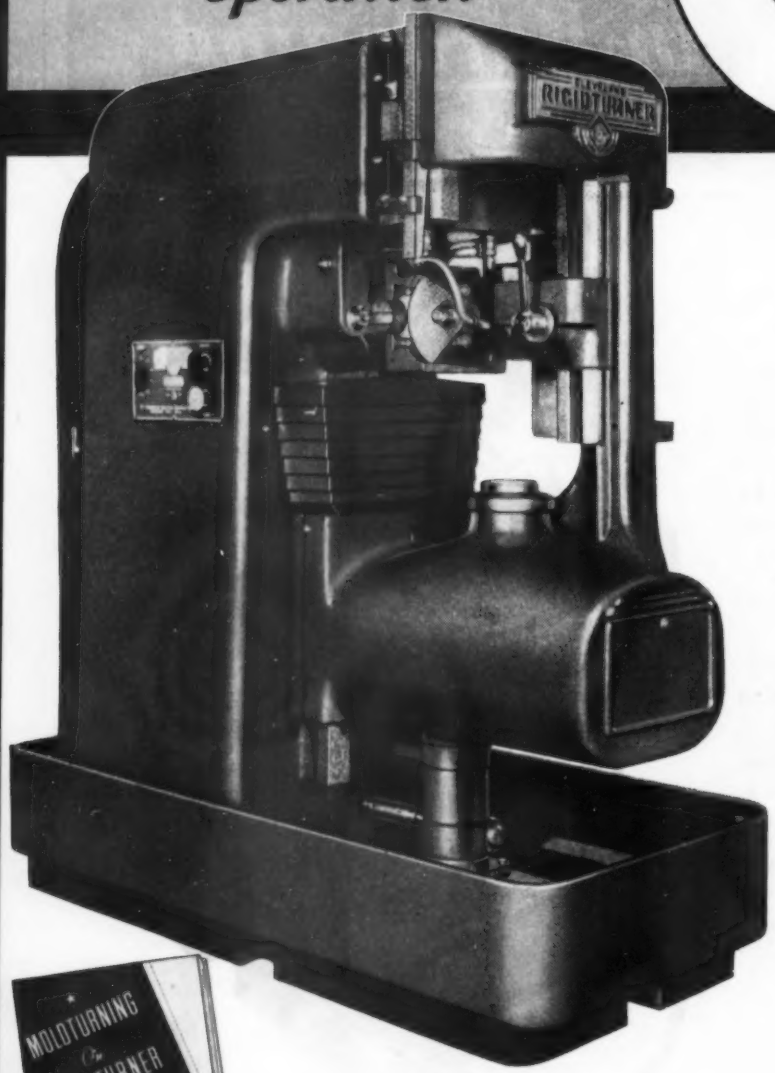
RED RING PRODUCTS

3600 ST. JEAN · DETROIT 13, MICH.

THE RIGIDTURNER

simplifies a difficult turning operation





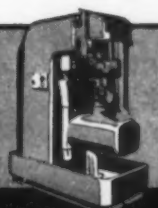
THIS BULLETIN tells how the Rigidturner operates—what work it will handle and how it can save you time and costs on turning multiple diameter work. Write for yours today

Here's the problem—turning the ends on an odd shaped aluminum Pump Jacket Cover. It was accomplished on the Rigidturner and close tolerances and accurate duplication maintained.

A special fixture permits turning both horns with same fixture and same special form cutter. The cutter turns a chamfer on the end of each horn and a 1¼ inch surface for hose connection. Only two bolts are required to hold work in position on fixture.

Turning is simple. The specially designed cutter is mounted on an arbor. The work revolves as it is advanced past the cutter which is rotated in variable timed relation to produce the desired diameters.

On your multiple diameter turning and turning of odd shaped work investigate the many advantages of the Rigidturner.



The CLEVELAND HOBBING MACHINE Company

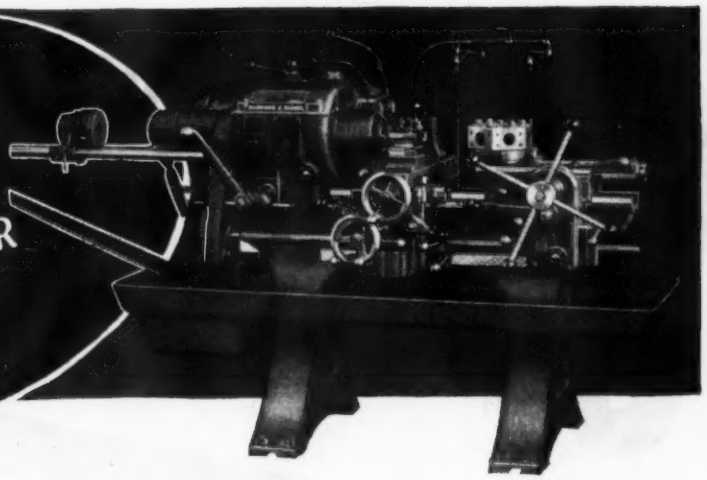
General Offices:
1311 CHARDON ROAD
CLEVELAND 17, OHIO

Chicago Office:
624 S. MICHIGAN AVE.
CHICAGO 5, ILLINOIS

BUILDERS OF RIGIDHOBBERS AND RIGIDTURNERS

Women Enjoy Operating

THE BARDONS & OLIVER NO. 3 UNIVERSAL TURRET LATHE



because it handles so easily.

A new (effortless yet powerful) hydraulic spindle brake enhances still further its long standing reputation as the EASIEST OPERATED AND MOST SENSITIVE UNIVERSAL TURRET LATHE.

Coupled with ample power, speed, rigidity, and efficient tooling, the important feature of ease of handling makes this machine an outstanding producer of small parts from bars, forgings or castings.

BARDONS & OLIVER, INC.
1133 WEST 9TH STREET CLEVELAND 13, OHIO

6 blades hardened every 10 seconds

10 KW RADIO-FREQUENCY GENERATOR

This unit has many applications. Its "table top" work surface eliminates the need for small tables, and all controls are centralized on the sloping panel. Large sturdy casters provide speedy mobility.

The job is to harden only the teeth of hand hack saw blades —with 6 blades completed every 10 seconds, or 36 blades per minute.

The amazing speed . . . accuracy . . . uniformity, all come with radio-frequency heating at 8500 Btu's per square inch per minute. Compare this with the old method, at 5 Btu's per square inch per minute.

Similar high speeds are possible in every metal heating job—annealing, hardening, brazing, sintering, forging and soldering. And the heating is so simple that it's a "push button" job for unskilled help.

Another great advantage comes with Westinghouse design . . . a single shielded cabinet contains generating equipment and controls, easy to install and maintain . . . requiring a minimum of space.

Westinghouse Radio-Frequency Generators for induction or dielectric heating are available in eight different standard sizes up to 200 kw, with a range of frequencies for all but the most unusual needs. For added information, write for Descriptive Data 85-800. Or, for aid on any specific application, ask a Westinghouse engineer to call. Write Westinghouse Electric & Manufacturing Co., P.O. Box 868, Pittsburgh 30, Pa. J-08098

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

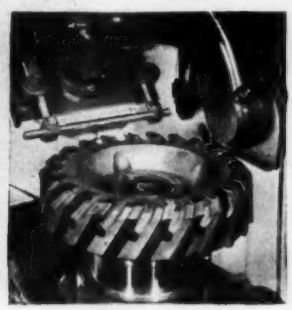
Electronics at Work

INGERSOLL
Cutters and Cutter Grinder

Ingersoll specializes in the design and manufacture of inserted blade milling and boring tools for use on all makes of milling and boring machines. A wide variety of standard types and designs of face mills, half side mills, staggered tooth slotting, helical slab and end mills cover most milling and boring applications. Modifications of these standard designs and special cutters are made to suit the unusual conditions. Cutters are furnished with high speed steel, cast alloy, or carbide tipped blades.

Write for cutter catalog describing complete line of standard inserted blade cutters.

CONVENTIONAL FACE MILL



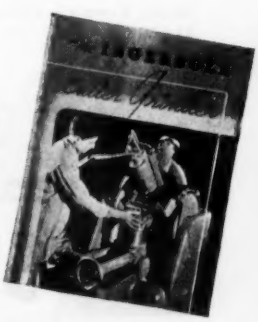
INGERSOLL SHEAR CLEAR

DOUBLE ANGULAR CUTTERS

To obtain best results with your milling cutters it is essential that they be properly ground. The Ingersoll cutter grinder is particularly designed for grinding face milling cutters at a single setting from 4″ to 30″ in diameter with maximum peripheral face of 7″. It will also grind solid shank, radius, staggered tooth, and angular inserted blade cutters. It is fast, accurate, and may be operated by the average mechanic.

The attractive 15″ x 23″ grinding chart gives basic grinds for standard milling cutters. These charts are suitable for mounting in a conspicious place in tool rooms and are available for free distribution on request.

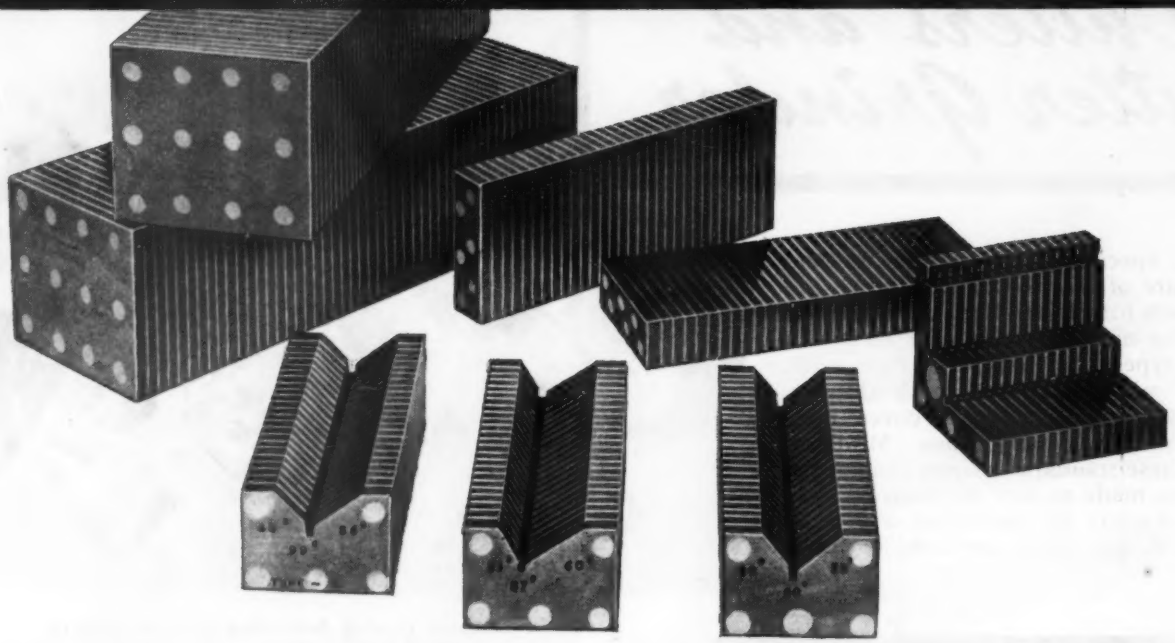
Write for cutter grinder bulletin which illustrates the wide range of application of this grinder and assists the operator in the best methods of grinding.



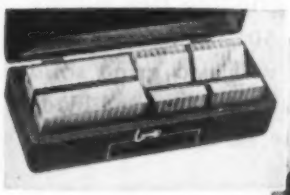
INGERSOLL MILLING MACHINE CO., ROCKFORD, ILL., U.S.A.

SCHERR MAGNE-BLOX

PARALLELS V-BLOCKS ANGLE IRONS



Part held at true vertical by Magne-Blox angle iron and two parallels. The magnetic principle of holding work is applied by the vertical side of the angle iron, as well as by the horizontal face of the chuck. The small laminations in the Magne-Blox transmit sufficient magnetic holding power to eliminate the need of clamps.



The universal set of Magne-Blox—two parallels, two V-blocks. Complete with case, $14.50

Set of toolmakers' matched angle irons, in case, $45.00

-- they transform magnetic chucks into special fixtures

Have you odd-shaped or small pieces to hold on surface grinders? Scherr Magne-Blox will serve as extensions of your magnetic chucks, enabling them to grip in spite of projections, difficult contours, curved surfaces, and to hold the work in the position required.

For instance, Magne-Blox angle irons permit of work to be held truly vertical, and at a vertical angle if desired, which can be accurately established with sine bar. Parallels in various dimensions, and V-blocks, can be combined to provide almost any holding contour to match the work. Available singly or in matched pairs, and in standard sets. Write for prices and full details.

Special Magne-Blox can be supplied, such as the V-blocks shown above, which are ground to special angles. Write for quotations.

GEO. SCHERR CO., Inc. 201 LAFAYETTE STREET NEW YORK 12, N. Y.

THIS *New Approach*

TO WHEEL AND COOLANT ENGINEERING

IS *Revolutionizing* GRINDING

PRACTICE AND RESULTS

QUAKER MICROGRIND PROCESS

applied to the grinding and honing operations in your plant, makes possible these specific benefits·

- Elimination of cracks on ground surfaces.
- Elimination of burns and distortion due to grinding.
- Much finer truly ground finishes.
- Greatly increased number of pieces obtained for each wheel dressing. (usually tripled)
- Immediate wheel life increase. (often 200% or 300%)
- Power consumption cut approximately 50%.
- Great increase in grinding production and virtual elimination of rejects.

A Quaker Process Engineer will welcome the opportunity to provide details and prove all the above claims *at our expense!*

QUAKER CHEMICAL PRODUCTS CORP.

CONSHOHOCKEN, PA.

Other Plants in CHICAGO and DETROIT Warehouse Stocks in Principal Industrial Centers

A Progressive Organization of Research and Process Engineers and Manufacturing Chemists

Name_____ Position_____

•••PLEASE PRINT COMPANY NAME AND ADDRESS IN MARGIN BELOW•••

RESEARCH - Basic Reason for Better Carbides

Years of unrelenting research by Philip M. McKenna resulted, in 1937, in the discovery of the hardest man-made material—a unique intermetallic compound, tungsten-titanium-carbide, corresponding to the chemical formula $WTiC_2$. This compound is the basic ingredient of steel-cutting compositions of Kennametal. It distinguishes them from all other cemented carbides.

Introduced in 1938, Kennametal quickly became established as the tool material that made possible machining of hard steel, accurately, at greatly increased speeds. Kennametal's spectacular performance in this field was a tremendous stimulus to increased research activities, which since 1938, have led to the successful development of:

- *a series of Kennametal compositions, of varying degrees of hardness, strength, and toughness, exactly suited for machining various types of steel, as well as tough, stringy non-ferrous alloys.*
- *a new, highly abrasion-resistant tungsten carbide Kennametal composition that cuts cast iron at greatly accelerated rates, with amazing tool life.*
- *a complete line of machining tools, designed to make fullest utilization of possibilities inherent in Kennametal compositions.*
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Research—looking to still further improvement in the properties and applicability of Kennametal—will continue, and expand, so long as the useful products of inventive genius are protected under an uninhibited American system of free enterprise.

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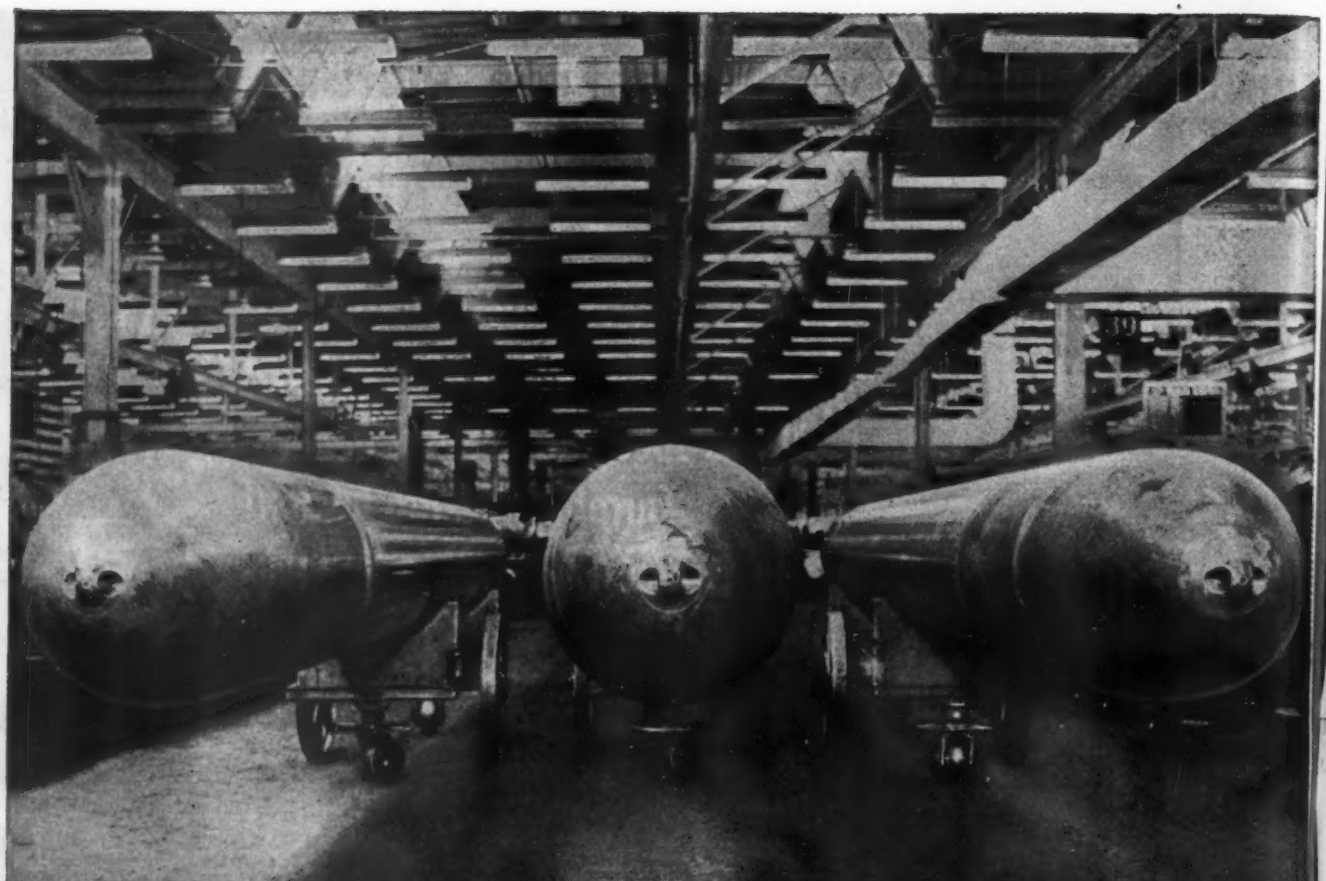

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RECONVERSION RUSTPROOFING

5 Points to Remember

1. Upon termination of war contracts, Government-owned production equipment must be rustproofed promptly, in accordance with *official instructions.*
2. Ordnance Specification P.S. 300-4 contains *official instructions* for the complete processing of such equipment.
3. These instructions require that only rustproofing materials meeting Government specifications be used.
4. *Texaco rustproofing products meet Ordnance specifications for application on Government-owned equipment.*
5. For full information, see your Texaco representative or write to us.

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Realism About Reconversion

BY DECREE of our military authorities "reconversion" is a forbidden word, not to be referred to verbally or in writing. It should be deleted from our vocabulary until after the war.

The truth is that they are afraid the term will have a damaging effect upon the war effort. They blame it, not their own bad guessing, for the easing off last fall and for the struggle afterwards to restore production to top volume.

They are right in assuming that the best way to wage a short war is to prepare for a long one. To be realistic in fighting a war is all to the good.

It is inconsistent, however, for those who believe in realism in prosecuting the war to advocate total and dense silence regarding what happens after victory.

It is no more than wishful thinking to believe that we can come up to the day of victory without well worked out plans for reconversion and still prevent a serious lag in employment and in industrial activity.

War production is now at a level of about $66,000,000,000 a year. No one in authority has said that there will not be cuts and cancellations in war contracts amounting to billions of dollars immediately following the defeat of Germany.

Even if the reduction were only fifteen percent, it still would be the equivalent of $10,000,000,000 of business, or nearly three times the volume done by the automobile industry in its most prosperous peacetime years.

Though V-E Day is likely to come within several months, nothing is being done to encourage manufacturers or industries as a whole to give thought to reconversion problems. Reconversion planning is frowned upon. If it is done at all, it must be done surreptitiously in a quiet, dark corner.

Our British allies are more realistic than we are. They don't indulge in such absurdities. They long ago asked several hundred of their industries to submit postwar programs covering their own individual industries. That has been done.

British newspapers, Parliament, government offices, speeches by top-flight officials, talks by business men and trades union representatives are full of postwar considerations.

Mr. Churchill's administration, with the backing of the British people, is doing its basic postwar planning now, not waiting until victory is won. If it didn't do that, it feels that it would be negligent in its stewardship of the Empire.

By contrast our war officials, who appear all-powerful now in the counsels of our government, adhere strongly to an ostrich-like policy. They cry "shame!" at the manufacturer if he dares mention "reconversion," though on the back of his neck is the breath of those who say that it is industry's major responsibility to see that 60,000,000 people are employed in this country after the war.

Reconversion consumes time—time to develop new products, time to refurbish old products, time to survey markets, time to retool factories, time to do many essential things.

If we start now, it won't be too soon. Let's restore our perspective and recognize that if we continue our present unrealistic policy about reconversion, we are risking economic dislocation of great magnitude immediately following victory.

Burnham Finney

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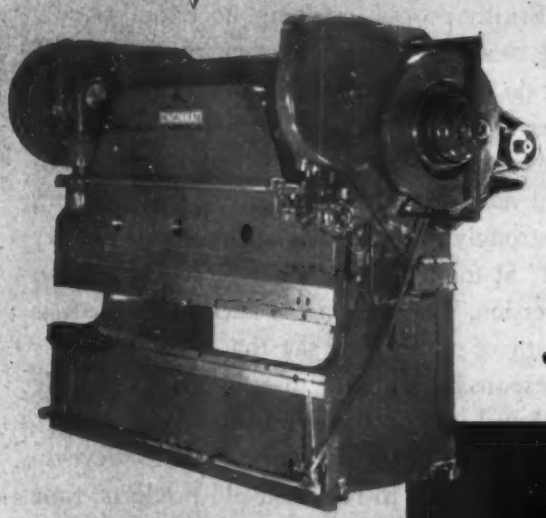

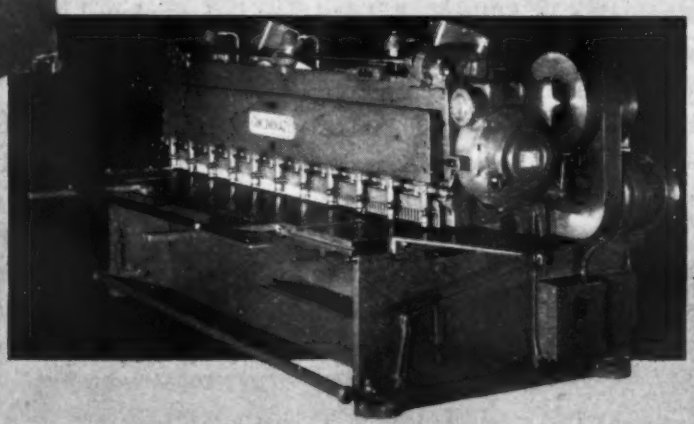

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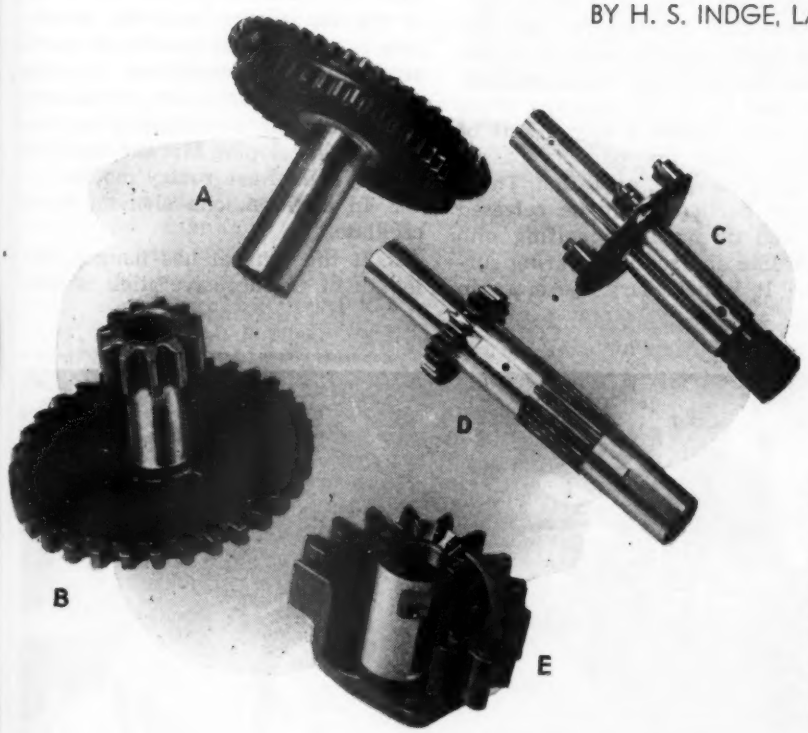
SHAPERS · SHEARS · BRAKES

Controlled Finish on Journals Can be Produced Economically

BY H. S. INDGE, LAPPING ENGINEER, NORTON COMPANY

Mechanical lapping with coated abrasive strip is a fast means of refining ground journals to surface analyzer readings of two to three microinches RMS, and do so on a consistent basis



COURTESY WRIGHT AERONAUTICAL CORPORATION

Lapped surfaces on these Wright engine parts are left bright; surfaces machined by other operations are painted black. Straight journals are Simplex lapped; thrust faces are lapped by other methods. Details of the Simplex lapped journals are:

	NAME OF PART	GRIT	CYCLE SEC.	STOCK REMOVED	LAPPED FINISH MICROINCHES, RMS
A	Oil pump drive gear....	320	30	0.0002	1-3
B	Gear and pinion.....	320	30	0.0002	5
C	Shaft assembly*.....	320	30	0.0003	2-3
D	Shaft*.....	320	30	0.0002	2-3
E	Reduction pinion.....	240	60	0.0003	2-3

*Two set-ups: 30 sec. cycle each set-up.

AIRCRAFT engine requirements have dramatized the importance of surface finish, but actually the refinement of commercially ground finishes rests upon a quarter century of development in mechanical lapping. Most of the pioneering work in this field was done because automobile manufacturers sought increased life of wearing surfaces. It has long been known that if surface finish is controlled, a journal bearing will sustain heavier loads for long periods of operation, provided that the factors of speed, lubrication and material are also taken into account.

There are, of course, several ways of lapping a journal—and a discussion of the various methods will lead to a better understanding of the art. Originally, cylindrical lapping was done by hand with split ring of cast iron or similar soft material. In this method, a closing device clamps the split lap upon the work, and loose abrasive and oil are applied between the work and the inner surface of the lap. The abrasive becomes embedded in the lap and cuts the rotating workpiece, thereby removing surface imperfections and geometrical ir-

regularities. Care must be taken continuously to take up wear of the lap or reduction in size of the work by adjusting lap pressure. Any looseness of the lap causes irregular lap wear and inaccuracy of the product.

Hand lapping produces the most accurate cylindrical surfaces, provided the operator is skilled in the art and follows the procedure faithfully. But hand lapping is limited by the operator's skill, and must be used on parts possessing the requisite shape. As matters stand, the method is now restricted to making individual plug pages or pieces wherein the quantity does not warrant elaborate equipment.

So it is obvious that even 25 years ago automobile manufacturers could not make extensive use of hand lapping methods, either because of cost or limitations imposed by the piece. In the case of the crankshaft, the crankpins and journals are located between flanges; they can not be finished with the ring-type lap used in hand processing. However, the earliest crankshaft lapping machines did use the equivalent of a ring lap. The lap halves or shoes were carried in a toggle device, which made it possible to lap between shoulders and at the same time to follow the throw of the crankpin.

There are limitations to the usefulness of this arrangement. Few crankshafts are hardened, and hence lapping with loose abrasive is contrary to best practice because the grains can embed themselves in the metal. Furthermore, the crankshaft has drilled holes, crevices and fillets which may harbor a few grains of abrasive after the part is passed through a cleaning operation. These abrasive particles may be released later and do harm by getting into the oil line and scoring bearing surfaces. It is necessary therefore to eliminate the use of loose abrasives.

At the time the crankshaft-lapping program was under development, the honing of internal surfaces was introduced. So it was with considerable confidence that stones or bonded-abrasive sticks were applied to external lapping operations. But two difficulties were encountered:

1. The physical impossibility of getting complete "break-up," or a non-repeating random path of the abrading element, to prevent creation of a definite scratch pattern on the work.

2. Selection of an abrasive that is bonded correctly for the work it must do.

In respect to abrading action, it is necessary in all lapping to achieve complete harmony between the area lapped and the area of the lap, together with the proper motion between work and lap. Without satisfactory relationships, uneven wear of the lap occurs, and this condition is reflected in quality of work produced. The conditions causing uneven wear of abrasive sticks are:

1. In lapping a cylindrical surface with an enveloping lap, the work or the lap must have rotary motion.

2. In addition, one element must oscillate.

3. If the journal has flanges, the length of the abrasive stick is lim-

In the hands of a skillful operator, a split cast-iron lap will produce an accurate cylindrical surface with an excellent finish, but the method is currently restricted to individual plug gages and similar parts

COURTESY WRIGHT AERONAUTICAL CORPORATION

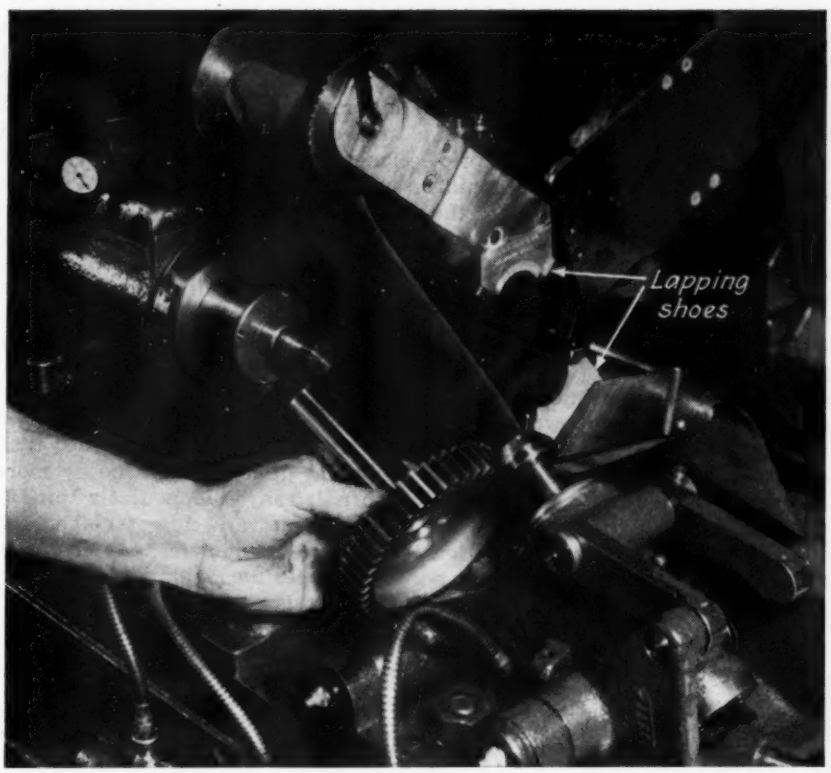
In the Simplex lapping method, a coated-abrasive strip envelops the journal, and is pressed upon it by lap shoes carried by a toggle-operated lapping arm. Here, a pump drive gear (ground to a finish exceeding 25 microinches RMS) is lapped to between one and three microinches RMS in 20 sec., using 240-grit cloth band. Stock removal, 0.0005 in.

ited to the bearing length minus the amount of reciprocation.

Thus, the abrading element must travel over a surface which is longer than itself. The motion of the reciprocating element may be uniform or harmonic, it may have little dwell or considerable dwell at each end of the stroke. Nevertheless, under all conditions, the sticks wear faster at the ends than at the center, and soon cause production of journal bearings that are "hollow," or small in diameter, at the center.

Many types of abrasives and all known bonds have been tried in an attempt to produce bonded-abrasive sticks which will produce uniform results and function repeatedly. If the bond is too hard, the surface of the abrasive stick will glaze and no effective work will be done. In glazing, the stick will pick up metallic particles which will score the work. Or, if the abrasive bond is too soft, it will break down rapidly, and neither abrades the work satisfactorily nor holds its shape long enough to produce an accurate product.

So far as abrasive is concerned, the problem was solved with the application of coated abrasive (cloth or paper backing upon which abrasive grains of uniform size are uniformly distributed and held by glue). By using strips of this material, correctly proportioned to the work, and properly supported to envelop the work, uniform results are obtained in lapping parts with simple journals or more complicated items such as crankshafts and camshafts. Before abrasive wear can become a factor, the work is finished and a new section of strip is used.

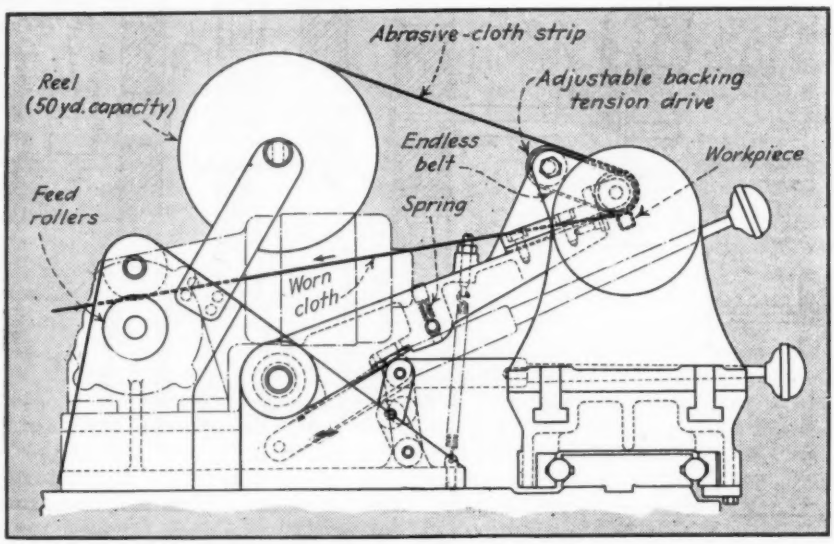


After finish grinding, the carburized journal of this generator drive gear possesses a surface finish exceeding 25 microinches, RMS. Hence it is finish lapped with a 240-grit cloth band to a reading of one to three microinches RMS in a machine cycle of 20 sec. Journal dimensions: length, 3 11/16 in.; diameter, 1¼ in. Cloth width, 3 11/16 in. Work oscillation, 1/16 in. Work speed, 750 r.p.m.

Furthermore, the geometry of the workpiece is not altered, because the abrasive strip is backed up by a cushioned support shaped to the work contour, and this support is not subject to wear.

While this method comes under the broad heading of "mechanical lapping," it is not lapping in a strict interpretation of the art. Rather, "Simplex" lapping, as the process is called, may be associated with Superfinishing, Mirra-finishing and Micro-finishing. The purpose of Simplex lapping is to refine the commercially ground surface on a journal by removing the surface "fuzz" down to the depth of the file-like grain marks created by the grinding wheel. Actually, the process removes some stock—ordinarily from 0.0002-0.0003 in. but sometimes as much as 0.0005 in. Thus, the offending sharpness of the ground finish, even if it has a Profilometer reading as low as eight microinches, root mean square, is removed. The lapped surface, which is commercially produced to two or three microinches RMS and even one microinch, has no sharp points to rupture the oil film and cause metal-to-metal contact and consequent wear. Bearing assemblies can therefore be specified with an initial clearance and specific oil film, and no attention need be paid to a "running-in" allowance such as was common some years ago.

In practice, Simplex lapping is carried out on standard or special-

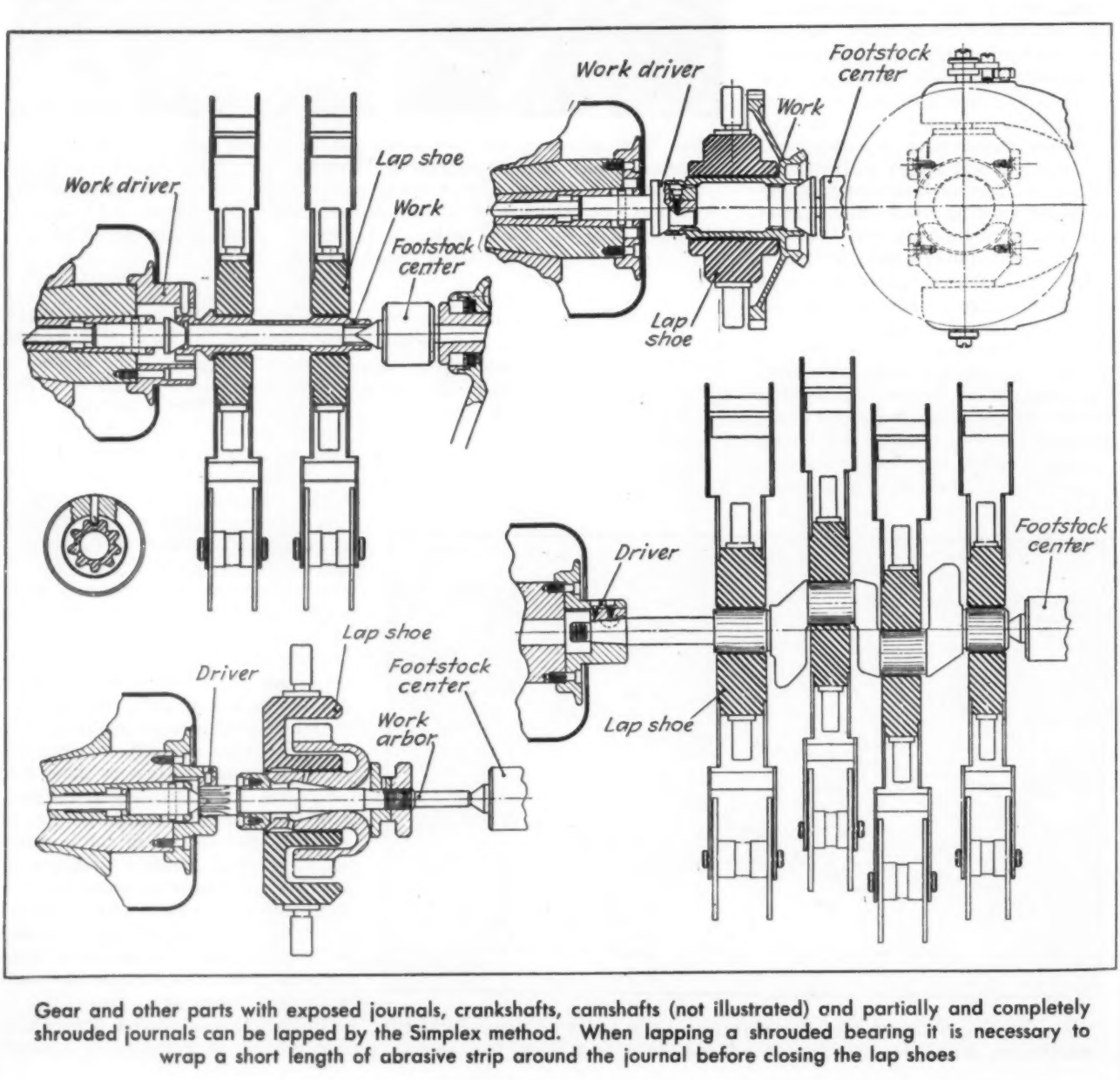


When lapping a square cam, the abrasive strip is fed over an endless-belt mechanism, which forms a cushioned nosepiece and gives line contact

purpose machines. In all cases, the work is held horizontally between centers, the headstock and footstock being mounted on a table which can be made to oscillate from 0-¼ in. with respect to the abrasive strip. One or more toggle-operated lapping arms are pivoted on a frame at the rear of the machine. These arms carry two work supports, or shoes, which can be caused to envelop the workpiece by operating the toggle. The abrasive strip is carried over spools from a reel at the rear, and envelops the journal when the shoes are clamped upon the work under uniform pressure. A take-up mechanism at the front winds up used abrasive. Usually a roll of strip will be sufficient to lap from 1,000 to 2,000 journals. If production lots are large, a machine may be arranged with automatic strip feeding mechanism. Completely shrouded journals can be Simplex lapped, but in that case neither hand feed nor automatic continuous strip abrasive can be used. Rather a short length of abrasive is individually wrapped around the journal before the shoe is clamped in position.

General-purpose Simplex lapping machines are intended to finish the journals of small machine parts, such as short shafts, gears with integral shafts and the like. Work up to 24 in. long and requiring a 12 in. swing can be accommodated, but capacity of the machine is limited by weight of the piece rather than physical dimensions. One or more journals can be lapped at a time. If the surfaces are close together and of the same diameter, one arm may carry shoes for lapping two journals: if journals are separated or of different diameters, more than one lapping arm can be brought into action.

Special adaptations of the Simplex lapping principle are used for lapping crankshafts and cams. The crankshaft lappers must have lapping arms that will follow the throw of the crankpins and journals. In cam lapping, a master cam, or where possible a duplicate of the product cam, is carried in line with the product to be lapped. A pivoted lapping arm carrying the abrasive element is actuated by following the master cam. The abrasive is fed continuously over a cushioned nose piece and is rapidly reciprocated while the work is slowly rotated. The amount of abrasive cloth fed during the operation is relatively small, but the continuously renewed abrasive prevents breakdown over the



Gear and other parts with exposed journals, crankshafts, camshafts (not illustrated) and partially and completely shrouded journals can be lapped by the Simplex method. When lapping a shrouded bearing it is necessary to wrap a short length of abrasive strip around the journal before closing the lap shoes

line contact which the nose piece makes with the work. The master cam follower is carried on a separate spring-actuated arm which allows for slight variations in the size of the product.

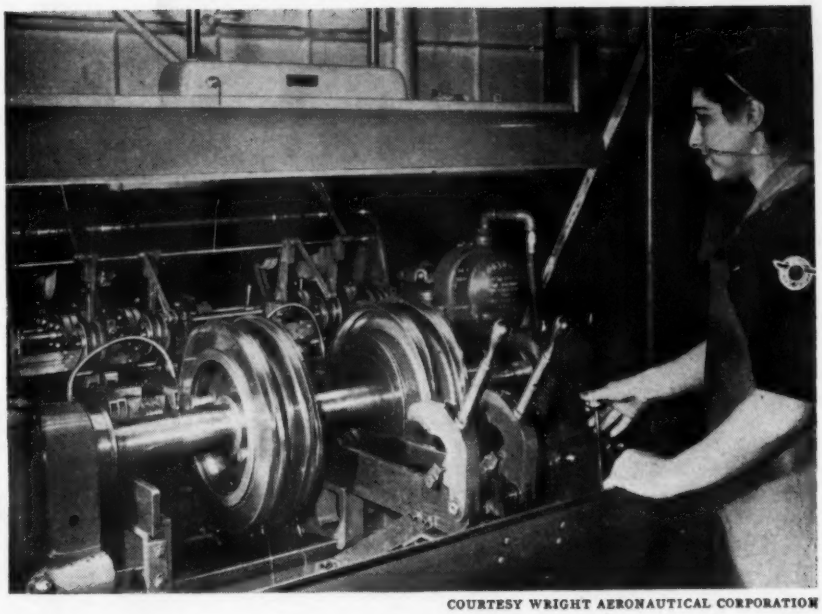
In the practical application of Simplex lapping to a product, the following factors must be taken into account: type of strip, width of strip, grit, surface speed of work, rate and amount of work oscillation, and cycle time.

Both paper-backed and cloth-backed strip are available. The paper backing is cheaper, is used where the width is great enough to withstand the stress imposed; under some conditions it may give a slightly better finish than cloth backing. The greater strength of the cloth backing is an advantage, especially on narrow journals.

The width of the abrasive strip is determined by the design of the journal. If the journal is flanged, the strip width is equal to the width of the journal minus the amount of work oscillation employed. On a journal without adjacent flanges or fillets, the strip is made equal to the journal width. If there is an adjacent fillet and this should be finished, the strip width is increased so that the edge will curl up and lap the fillet. However, if a thrust face is to be lapped in addition to a journal, the strip width will be further increased and the edge will be slit at intervals of ⅜ to ½ in. Then, the edge of the strip will turn up enough so that contact will be made momentarily on the thrust face during oscillation of the work toward the lap shoe. The lapping arm should be set with respect to the thrust face so that momentary end pressure occurs on the shoe at the end of the stroke.

The size of grit is of course one of the most important matters affecting economical production of the desired surface finish on lapped products. Four grits are used: 240, 280, 320 and 400. The 320-grit is most commonly used; the 240 and 280 grits are frequently applied when lapping very hard steels because during the early stages of the lapping cycle the grains are sharp and cut easily, but later they dull or glaze and produce a finish comparable to the 320-grit abrasive. The 400-grit strip is applied to lapping nitrided journals, where the ground finish is comparatively good and stock removal is about 0.0007 in.

Selection of grit can be expressed another way: One aircraft-engine manufacturer relates grit size to original surface finish of the ground piece as well as to hardness of the material. The 240-grit is used when hardened or carburized journals are ground to a Profilometer reading in excess of 25 microinches RMS; the 320-grit for hardened and ground parts with a reading of 25 microinches or less, and the 400-grit for nitrided journals which are finish ground to 12 microinches.



COURTESY WRIGHT AERONAUTICAL CORPORATION

While most gear parts require a lapping cycle of 15 sec. to one minute, very large items such as inlet and outlet cams for the Cyclone 9 engine may take from eight to 15 min., depending upon the original ground finish. Such pieces are shown being finished on a Cam-O-Lap machine which employs the same principle and lapping medium as the Simplex machine. The right-hand and left-hand members are the master cams. The latter control the movement of the lapping arms, thus insuring a uniform finish without change to contour of the cam track

Work speed has an important effect upon lapping action. Too slow a speed will not produce the desired action, which is really that of honing with a rigidly supported abrasive band; too high a speed is inadvisable because it changes the action from honing to polishing. High speed is impractical where parts lack sufficient rigidity or balance. Thus, to obtain a bright finish one would use a faster work speed; to get a lower microinch reading, reduce the speed. So if one is lapping a 1-in. diam. journal, a work speed of 600 to 700 r.p.m. is customary, provided that the part can be successfully rotated at such speeds. For other sizes of journals, working within the range of 100 to 150 s.f.m. per min. is safe practice.

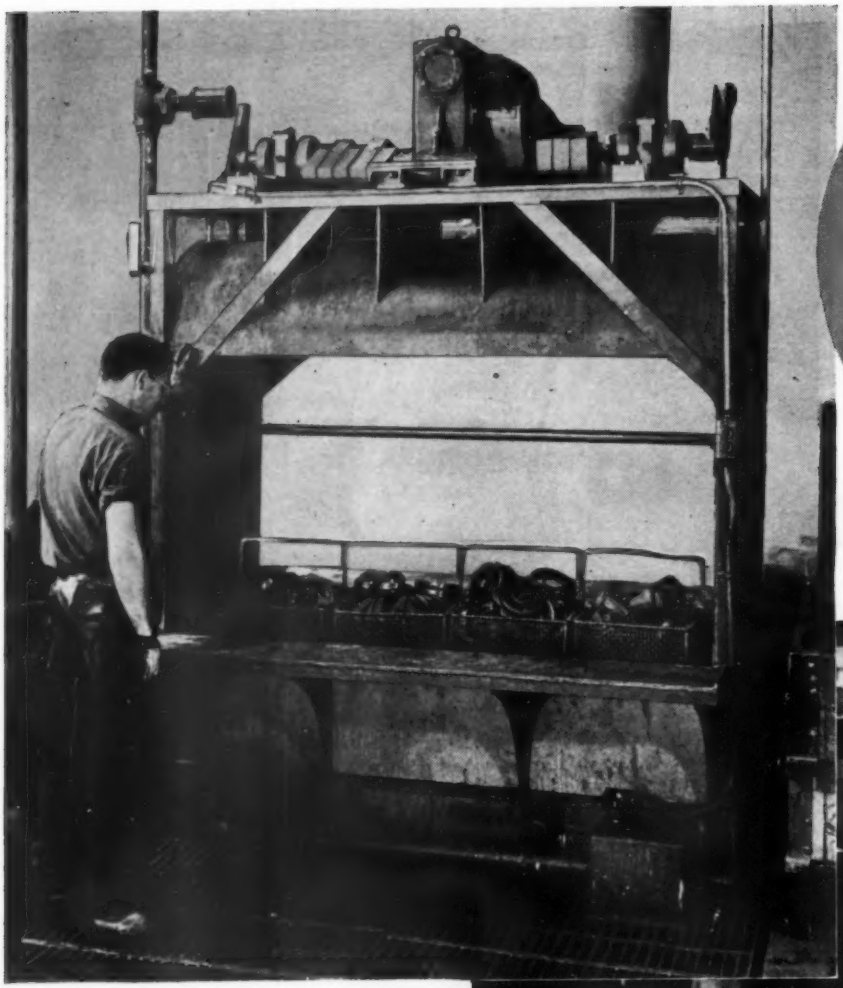
Oscillation of the work is accomplished by a mechanism which reciprocates the table on which the headstock and tailstock are mounted. Table travel is adjustable from 0 to ¼ in., but a 1/16 in. reciprocation usually suffices. The length of reciprocation is usually critical, but the work speed and the rate of oscillation of the table are less important. So far as rate of oscillation is concerned, it is proportional to both the diameter and the width of the journal, and must be established by experience.

Cycle time is not too critical. General-purpose equipment will handle journals from ½ to 2 in. in diameter by several inches long, or narrow journals up to 4 in. diam. A cycle from 15 sec. to one minute will usually suffice. Most jobs take less than 30 sec., and the grit used has little effect upon the length of time required to secure a given finish. The machine is equipped with a timer, and if certain parts in a lot do not possess the desired surface finish after one cycle, the cycle is repeated. Abrasive is not changed.

Coolant is always used. Either kerosene or mineral seal oil, or mixtures of these two, can be employed.

The refinement of ground surfaces by Simplex lapping to one-third or one-quarter of the surface analyzer reading secured on the ground parts can be done either in the production line or in a centralized lapping and honing department.

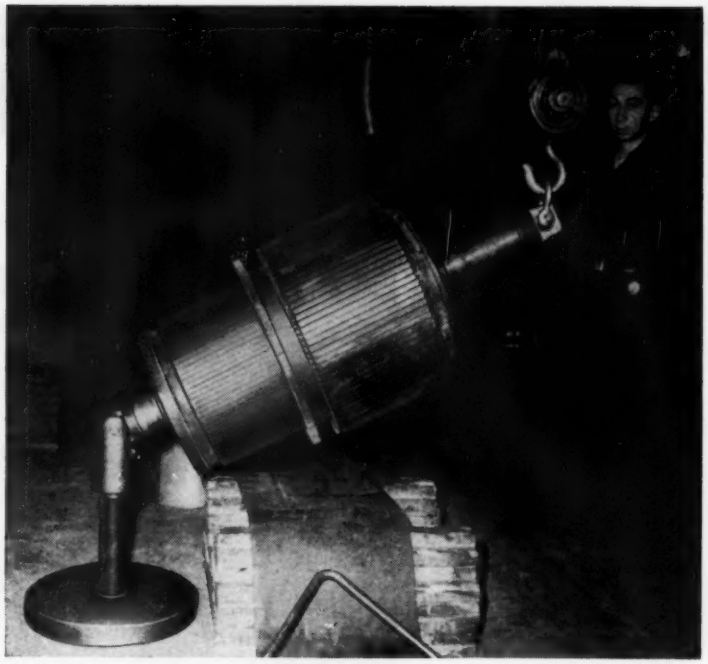
SHOP SHOTS



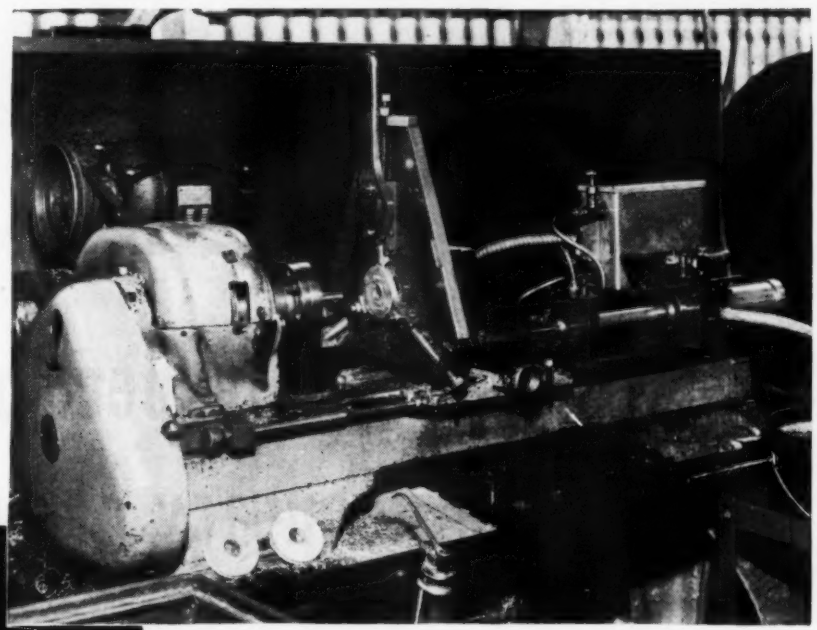
Repeated "dunking" of basket loads of small castings in a heated cleaning and degreasing solution cuts the time required for cleaning materially without fatigue on the part of the operator. This special machine has a tank in which the cleaning solution is maintained at 130 to 140 F. by circulating it through a heat exchanger connected to the hot water supply main of the forced hot water heating system in the plant. Supported above this tank is a vertically - reciprocating carrier which operates at 30 strokes per minute. Movement of this carrier is 12 in. This carrier is of sufficient size to support four loaded baskets of small castings, having a gross weight of approximately 1,000 lb. The counterweighted crankshaft for reciprocating the carrier is mounted above the machine directly under a motor-driven speed reducer as shown. The frame of the machine is of welded steel construction. *Bell & Gossett Company.*

Countersinking contoured wing skin panels for the B-29 bomber was, until recently, a difficult job because every countersunk hole must be at right angles with skin surface so that the rivet head will be flush when pulled up. With the standard table the panels could not be held accurately in relation to the countersinking spindle. Ralph Harsin, a Boeing-Wichita employee, suggested the use of adjustable rollers on a fixed table so that countersinking of these sheets could be done evenly. In the improved table, a row of support wheels is in line and level with the countersink pilot. Opposite this row of wheels is a row of rollers. With one edge of the contoured wing skin resting on the wheels and the opposite edge on the rollers, the skin can be fed easily into the machine. Convenient hand cranks permit raising or lowering the rollers until the skin is level. *Wichita Division, Boeing Airplane Company.*

Heavy armatures can be turned from a horizontal to a vertical position, or vice versa, with one crane and by one man. Two caps are screwed on the ends of the armature shaft; welded to these caps are plates with holes in them. A pedestal, with an adjustable top, is put under one end of the armature, and a pin is placed through the hole in the cap. A U-shaped clevis and pin are placed on the other end, making the armature ready to be up ended. The operator places the cranehook in the clevis, and as he lifts the armature, he moves the crane to a position over the pedestal. When the armature is upright, he removes the pin from the pedestal top, and the armature is free to be moved away. This method of handling armatures eliminates the necessity of a two-man operation, tying up two cranes. It also greatly reduces the danger of damaging armatures. *H. B. Leidy, Westinghouse Electric & Manufacturing Company.*



Pipe cooling coils sometimes have one or more turns bent in a direction parallel to the axis of the coil. This operation has been made easier in the Transportation & Generator Division by providing an auxiliary pneumatic cylinder which can easily be positioned on the coiler when these bends are necessary. The tool is not heavy, and the operator can manipulate it without the use of a crane. By opening an air valve in the handle, air is admitted into the cylinder at a rate which will form the bend without damage to the copper tube. After the bend has been made, the cylinder is removed from the coiling fixture and additional turns are coiled in the regular manner. A special head on the end of the piston rod of this auxiliary tool eliminates flattening the tube during the side bending operation. Standard shop air pressure is used. *Westinghouse Electric & Manufacturing Company.*



When finishing die-cast aircraft cable pulleys, the most exacting job is boring the center hole, which must be kept within 0.0005 in. of the specified diameter. A 10-in. Atlas lathe was equipped with a special carriage fixture having hydraulic controls and feeds to diamond-bore these holes. Various sizes of pulleys can be held in the adjustable fixture which is mounted on the stripped carriage of the lathe. The fixture jaws are arranged to grip the pulley in the cable groove, and the top jaw has a cam-operated slide for quick opening and closing. Once set up for a given size of pulley, the two lower jaws are not moved for loading and unloading the work. A double-acting hydraulic cylinder is mounted on the ways at the right-hand of the bed. Control valves, operated by a rod connected to the fixture support bracket, provide an automatic feed cycle. The operator places a new pulley casting in the fixture and opens a valve to start the cycle. The spindle drives a boring bar carrying a diamond-tipped tool at approximately 4,000 r.p.m. *Western Die Casting Company.*

Inside and outside diameters are deburred and radiused with emery cloth at these finishing stations on the inspection bench. One side of the ring is finished at the first station, then the ring is turned over for finishing the other side at the second station. A suction hood removes dust at each of these work stations

Progressive Inspection Stations Assure Accuracy of Piston Rings

BY D. M. SMITH, CHIEF ENGINEER
ST. LOUIS DIVISION, McQUAY-NORRIS MANUFACTURING COMPANY

DIMENSIONAL ACCURACY is essential in the production of piston rings, especially those employed in aircraft engines where the ultimate in performance, reliability and efficiency is demanded. Many years of experience in the manufacture of commercial precision piston rings for gasoline engines of all types has enabled the piston ring department of the McQuay-Norris Manufacturing Company to set up for the mass production of high quality piston rings for aircraft engines while still making many rings for engines employed as motive power by our mechanized armed forces.

Close dimensional tolerances of aircraft rings require additional checking stations to those used in inspecting commercial rings

Like the commercial piston rings made by McQuay-Norris in peacetime, aircraft engine piston rings are made from individual ring castings of high quality alloy iron. These castings are turned and bored, and then finished in precision grinding and lapping machines to the tolerances for dimensional accuracy and surface finish demanded by the aircraft engine manufacturers' specifications.

McQuay-Norris has made extensive use of progressive inspection procedures to check rings for aircraft engines on a mass-production

basis. These procedures were developed before the war for checking commercial rings. However, since aircraft engine rings generally require 100 percent inspection of all specified dimensions, the progressive inspection benches set up for checking aircraft engine rings necessarily incorporate many more checking stations. Only certain dimensions are checked 100 percent on most commercial rings and other dimensions are spot checked at frequent intervals to insure maintenance of the accuracy of machining and finishing operations.

Inspection Stations Increased

The McQuay-Norris ring shops are laid out with complete machining and inspection lines for different sizes and types of rings. Two machining lines usually feed into one inspection bench, with the rings from each machining line going down opposite sides of the bench. Most aircraft rings, however, require so many inspection operations that the entire bench must be given over to the checking of one size and type of ring. In such cases, rings are passed back and forth across the bench, in addition to being moved progressively along the bench, as inspection and finishing operations are performed. Machining and inspection lines are set up for steady flow of work down the lines without a build-up of stock at any point. This eliminates the development of a large, expensive inventory.

Whether devoted to checking commercial or aircraft engine rings, all inspection benches have stations for some of the final finishing operations required. This is done both because it is less expensive to provide supervision for a single group of benches than to install a series of finishing benches and a series of inspection benches, and also because the precise tolerances specified on most of these rings makes it necessary that the finishing be done with as much care as any of the inspection operations. Immediate inspection detects finishing flaws rapidly.

Inspection and finishing operations performed on a typical aircraft engine ring follow:

At the end of each machining line, the rings are suspended on metal racks and dipped in oil to prevent rusting. At the start of each inspection bench, an operator dips these racks of rings in a holding solution which removes the oil coating and deposits a thin film coating which protects the rings from rust and other corrosion for about 8 hr. Racks of rings so treated are suspended above the dip tanks to drain until needed at the inspection bench. As the rings are needed, this operator passes them through a ring-type demagnetizer and suspends them on an angle-iron rack at the first inspection station on the bench.

The first inspection operation consists of a visual check for foundry flaws and mechanical errors. Next, all dimensions, grooves, channels, slots, radii, face flats and bevels are checked visually and with gages. At this second station on the bench, every dimension and surface except the width and end clearance are checked. Also, face light, circularity and load checks are made. There is a 100 percent check on the first 25 to 50 rings of a batch. If no errors are found in this group of rings, the inspector at this station then spot checks about ever twentieth ring with gages and visually inspects the rest. However, if a bad ring is found in the first group of 25 to 50 rings, all rings in the batch must be gaged 100 percent. A record is kept of rejection causes.

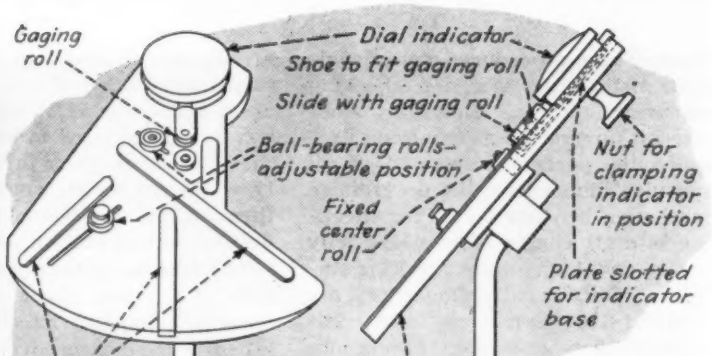
Next in sequence along the inspection bench, on either side, are two stations where the corners at the inside and outside diameters on each side of the ring are deburred and radiused. Each station consists of a vertical cup having a lip into which the ring is compressed to hold it tightly while being rotated. The cup is driven by a vertical shaft at a speed of 1,450 r.p.m. by a 1/3 hp. motor under the bench. A treadle switch on the floor starts and stops this motor. While the ring is rotating, the operator holds a pad of No. 240 grit emery cloth against the inside and outside edges of the ring.

Specifications Are Exacting

After the edges on one side of the ring have been finished, the ring is removed and passed along to the next station where it is inserted in a similar cup for finishing the edges on the other side. For some of the rings, the specified radius is difficult to hold. For example, the specifications for some aircraft engine rings call for a maximum radius of 0.003 in. on the outside lower face corner. Rejections are high for this ring because of the difficulty of holding such a small radius within the tolerances required.

Further along the inspection bench, the next operation consists

Progressive inspection benches developed during prewar years make it possible to check commercial and aircraft engine piston rings at much lower cost than if it were necessary to inspect the rings individually. Rings are passed from station to station along these benches until they reach the packaging stations at the far end of each bench



Widths of piston rings are checked on the gage shown at left. A dial indicator on the gage gives a direct reading as the ring is rotated under the indicator spindle. A piston ring thickness gage, sketched at right, can be tilted for the convenience of the inspector. Rollers locate the ring with relation to the dial indicator

of a visual inspection of the quality of the lapped face surface. Then, at the next station, each ring is checked for end clearance. The end clearance dimension can be checked either by compressing the ring into a ring gage and then measuring the distance between the gap ends with a feeler gage, or by compressing the ring with a steel band in a special gage which measures the gap dimension with a dial indicator. Usually, a small bench grinder with a narrow-face wheel is placed near this station so the inspector can increase the size of the gap when necessary.

A "face light" inspection follows the end clearance check. For this operation, the ring is snapped into a steel ring gage having a shield inside its bore which permits light rays from a lamp back of the shield to pass into the ring gage around its inner periphery. Thus, any peripheral irregularities on the ring are shown up quickly by the amount of light showing between the ring and the gage. Usually, a showing of 0 to 10 percent light around the periphery is permitted, depending upon the type of ring being inspected.

The next two inspection operations consist of checking the width and thickness of each piston ring with dial indicator gages. Width of the ring (that is the height of the ring cylinder) must be within 0.0005 to 0.001 in. of the specified size, depending upon the ring being inspected. Wall thickness of the cylinder must not vary more than 0.004 in. in any one ring. From ring to ring, the tolerance on thickness generally is about 0.010 in. As indicated in the accompanying illustrations, the width gage consists of a surface plate over which is supported a 0.0001 in. dial indicator. The ring to be checked is placed on the horizontal surface plate and it is then rotated by hand under the spindle of the indicator. A lever is used to raise the indicator from the ring at the end of the inspection cycle. The thickness gage has a tilted cast iron plate with hardened steel inserts to reduce wear when the ring is rotated over guide rollers past a movable roll which serves as a contact for the spindle of the dial indicator. A shoe on the end of the spindle rides on this gaging roll.

Next, each ring is checked for circularity. For this operation, the ring is snapped to a steel band of accurate periphery. Then, the assembly is placed on a tilted surface plate between a fixed gaging point and the spindle of a 0.001 in. dial indicator and rotated to check the diameter in two positions 90 deg. apart. When the ring is closed in a steel band to a specified width of gap, which is set for each ring size and type, it usually is about 0.010 to 0.030 in. larger in diameter when measured across a diameter passing through the gap than when measured across a diameter at 90 deg. with the gap.

The next inspection operation consists in checking the diametral load or weight required to close the ring to a specified gap size, or to close the ring to a specified diameter. A load required for the two methods of checking differs slightly and rings generally are checked both ways. The average aircraft engine ring requires from 9½ to 11½ lb. to close

The "face light" check is made by snapping the piston ring into a steel ring gage having a shielded electric lamp in the rear. Light showing around the periphery of the piston ring is a measure of its circularity when compressed to the proper diameter

the gap to a specified size. For this operation, a foot-operated fixture compresses the ring which is supported on the table of a standard precision bench scale. The ring is supported in a vertical position by holding it against a vertical plate attached to the table of the scale.

The next operation consists of breaking the inside diameter corners of the gap. This finishing operation can be performed with a thin grinding wheel on a bench grinder, the thickness of the wheel being governed by the width of the gap. Where only a small amount of material must be removed, a length of fine file can be set on edge on a surface plate and the ring gap drawn across the file by hand. On other benches, where small rings are inspected and finished, vertical abrasive belt grinders using narrow belts and a thin guide plate are used for this operation.

The next operation consists of milling a series of grooves across the face of one side of the gap to provide a permanent identification of the manufacturer of the ring. For this operation, the small cutters are mounted directly on the shaft of a bench-mounted motor. Feed of the work to the cutters is by hand. For further identification, the type of ring is acid-etched on one side with a rubber stamp. Then comes a final visual inspection, a recheck for width, a recheck of end clearance using a ring gage and feeler, a check to insure that the acid-etching is on the proper side of the ring, and a dip in a rust preventive solution. Finally, at the end of the inspection bench, the rings are wrapped and packed in cartons.

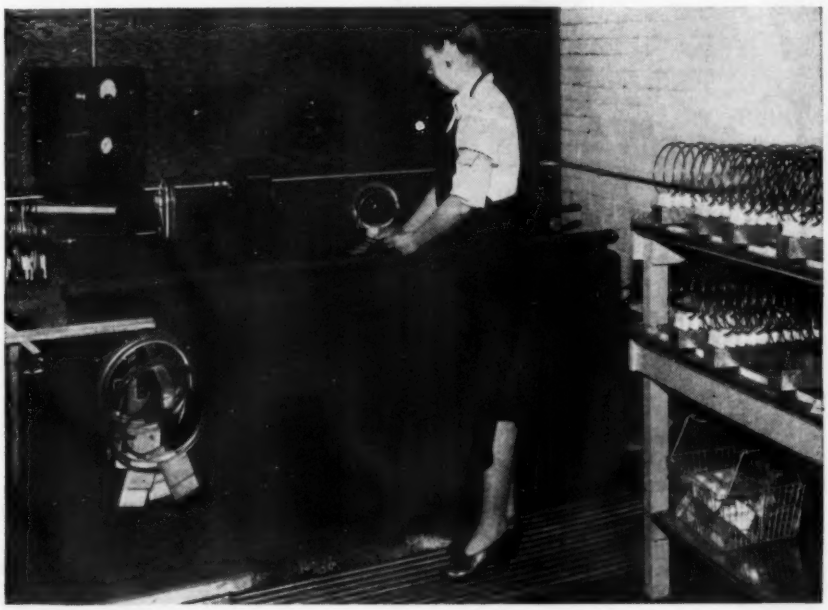
Piston Rings Are Plated

Some of the piston rings manufactured by McQuay-Norris are Altinized, others are chrome plated for wear resistance. Rings that are to be plated first are passed along the inspection bench for a preliminary check to insure that the parts delivered to the plating tanks are accurate. For Altinizing, the rings feed directly from the inspection bench to a nearby plating group where they are racked and plated according to carefully worked out specifications. After plating, these rings are returned to the same inspection line. The return of these rings is speeded materially by using infra-red lamps for drying after plating.

Some commercial rings and most aircraft engine rings have a tolerance for quality of finish of the side surfaces. When quality of finish of the sides is specified for commercial rings, they generally require a finish of about 20 microinches. Aircraft engine rings, on the other hand, generally call for a finer finish of about 10 to 12 microinches. Some aircraft engine rings specify a finish as fine as a maximum of 6 microinches. Rings made to such specifications usually are spot checked by sending them to an inspection laboratory where a surface analyzer is used to measure the roughness of the side surfaces.

Rings rejected for any reason along the inspection benches are not scrapped, but go to reinspection benches where a "process control inspection group" culls good rings from bad. Any rings that are at all questionable are culled out at the main inspection benches to avoid tying up the inspection line.

Corner breaking and identification operations are performed on opposite sides of this inspection bench. The girl in the foreground is using a wheel to break the inside diameter corners of the gap of an aircraft piston ring

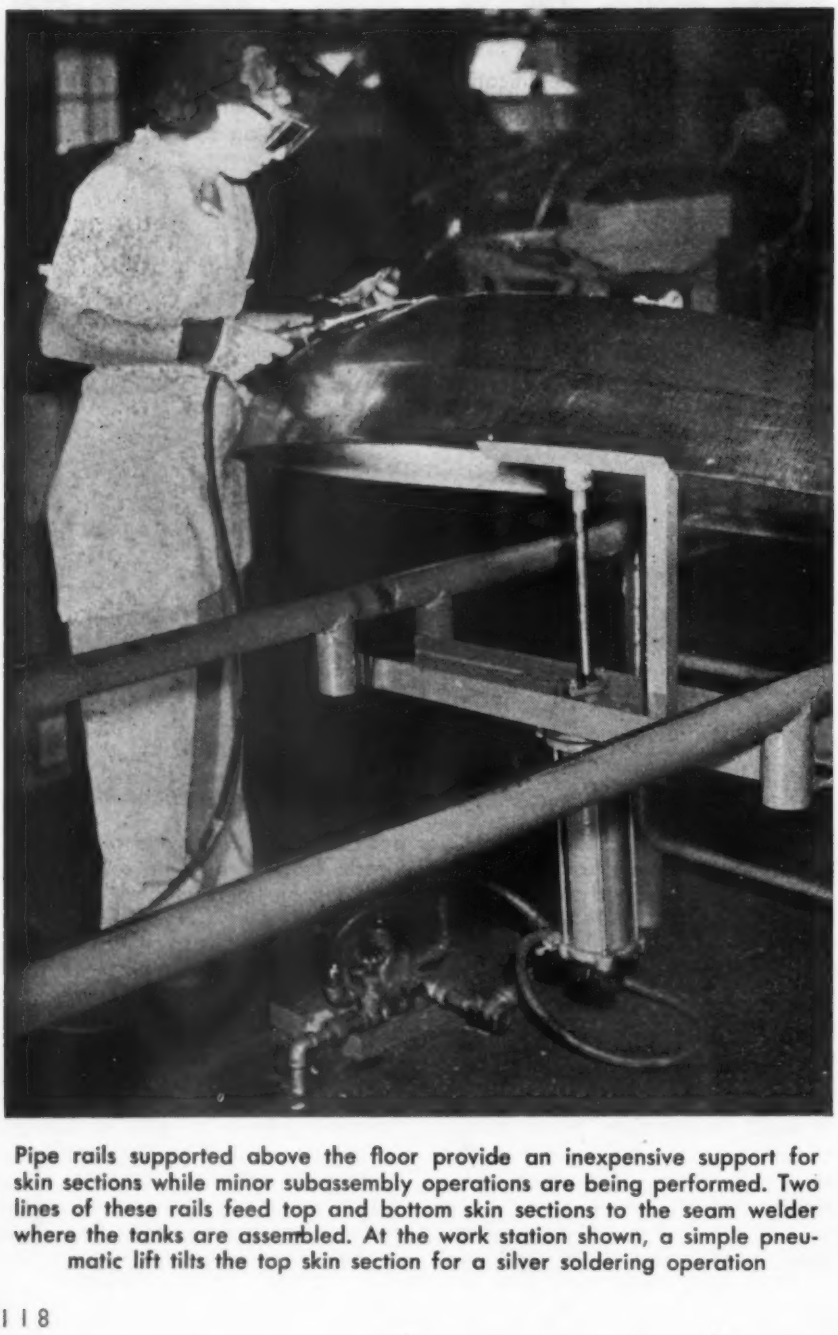


Magnaflux and Zyglo equipment has been installed to provide a constant check of the quality of the rings produced. Special racks have been developed to facilitate these inspection operations

Conveyors Aid in Assembly Of Auxiliary Fuel Tanks for Planes

Both sections of the droppable tanks are automatically seam welded on lines formerly used in manufacturing gas ranges

BY BEN C. BROSHEER
ASSOCIATE EDITOR, AMERICAN MACHINIST



Pipe rails supported above the floor provide an inexpensive support for skin sections while minor subassembly operations are being performed. Two lines of these rails feed top and bottom skin sections to the seam welder where the tanks are assembled. At the work station shown, a simple pneumatic lift tilts the top skin section for a silver soldering operation

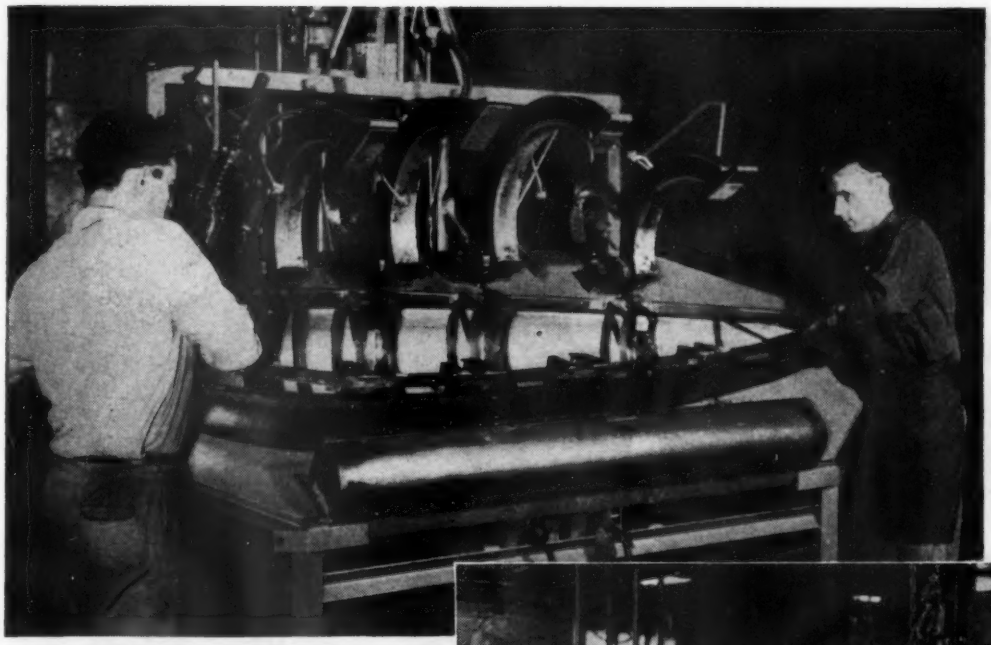
THE OPERATING range of many American pursuit planes has been increased materially by equipping them with auxiliary fuel tanks which, when empty, can be dropped while the plane is in flight. These disposable tanks are carefully streamlined to minimize air resistance while the plane is in flight and they are assembled from thin sheets of terne plate which provides a lighter tank than the previously used aluminum and still provides maximum cleanliness.

Two sizes, one having a capacity of 110 gal. and the other a capacity of 75 gal., are being manufactured for the Army Air Forces by the Quick Meal Division of the American Stove Company in a plant formerly devoted exclusively to the manufacture of domestic gas ranges. Insofar as possible, equipment originally installed for manufacturing ranges has been converted for operations on the fuel tanks.

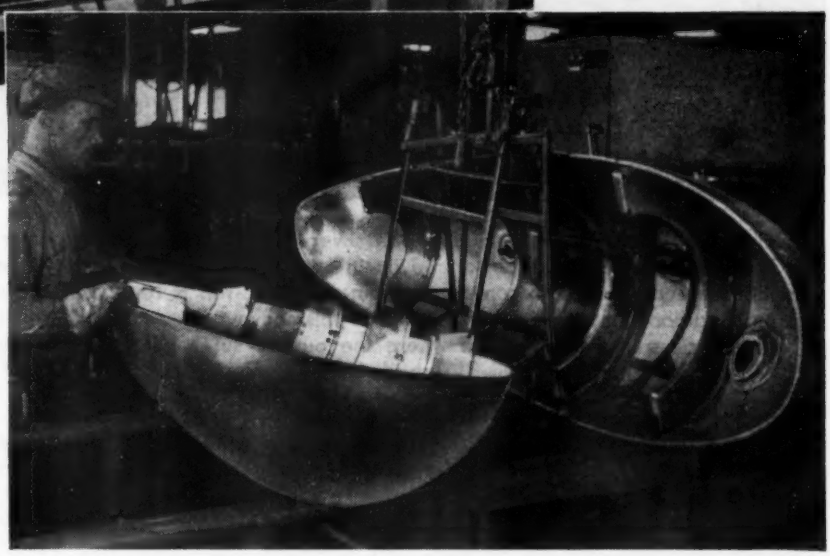
Half-skin sections are formed in one draw in a large hydraulic press; 0.030 in. thick terne plate sheets for the 75-gal. tank skins and 0.035 in. terne plate for skin sections of the 110-gal. tanks. Baffles for both sizes are formed from 0.025 in. thick terne plate in crank presses that in prewar days were used to make stove parts. The assembly of these tanks has been conveyorized as much as possible, with separate departments being set up for the assembly of each of the two sizes.

In each of the assembly groups, subassembly operations are completed on each of the top and bottom components before they are joined by seam welding to form a completed tank. These subassembly operations are performed along work lines made up of pipe rails which support the work at a convenient height. Along these lines, support lugs are fitted and riveted to the top skin section, filler tubes are fitted and silver soldered and other fittings are silver soldered in place.

Near the end of each of the subassembly lines is a special baffle welder, designed and built by American Stove Company engineers, for



Special welding fixtures have been developed for resistance-welding baffles inside the top and bottom skin sections. Thyratron-controlled welder has a pneumatic-hydraulic gun which operates in the following sequence: (1) squeeze, 7 cycles; (2) weld, 3 cycles; (3) hold, 7 cycles; (4) off, 8 cycles. The gun is repositioned during the "off" portion of the welding cycles



Assembly lines for the top and bottom skin sections meet at this point. Here, a top and a bottom section are supported on an angle-iron cradle for immersion in a vapor-type degreaser. An overhead electric hoist lifts the cradle into the degreaser, and then moves it to a nearby tank assembly fixture where the mating seam is tack welded

locating and spot welding baffles in position inside each of the skin sections. Each fixture consists of a baseplate which is cut away in the center to fit the contour of the skin section. Under this plate is a cradle ring for each of the baffles. Opposite the cradle rings are clamp rings which are closed over the assembly when ready for the welding operation. Baffles are located inside the skin section by an auxiliary fixture which is lifted into the skin after the skin has been placed in the cradle of the welding fixture.

Welding is done with a short-circuiting gun which completes the electrical circuit between the copper-faced clamp and cradle rings. This gun operates automatically once the welding cycle has been started. It is closed by an air-hydraulic booster which is controlled by the same unit which operates the welder. This Thyratron-controlled 75 kva. unit has a repeat timer which provides a four-part welding cycle consisting of (1) squeeze for 7 cycles, (2) weld for 3 cycles, (3) hold for 7 cycles, and (4) off for 8 cycles on a 60-cycle supply current. This makes a total of 25 cycles for each weld. The operator can average about 100 welds per minute, since the positioning fixture has guide rings to aid in locating the gun for each weld. The 110-gal. tank has four baffle rings while the 75-gal. tank has two. A foot-controlled switch initiates the welding cycle; as long as the switch is held closed the welder automatically repeats the welding cycles, with the "off" portion of each cycle being long enough to permit the operator to move the gun to the next position around the arc of the baffle joint. When the baffles have been welded in place, the subassembly is returned to the pipe rail production line for movement to the degreasing station.

At the degreasing station a top and a bottom tank half section is secured from each of the subassembly lines and the pair of subassemblies is supported on an angle-iron cradle from an overhead electric hoist. The operator of this hoist moves the cradle load into a vapor-type degreaser and then to a tank assembly fixture where an operator and a helper align the two tank halves for seam welding. The halves are spot welded together in this fixture to insure accurate alignment. A 50-kva. Thyratron-controlled, scissors-type welding gun is employed for these spot welding operations. The operator makes a spot weld about every 6 in. around the seam, with about 25 spots being required on the 75-gal. tank and about 32 spots on the 110-gal. tank.

Assembled and spot-welded tanks are moved to a 150 kva. standard Taylor-Winfield seam welder which has full synchronous Thyratron-control. Here, seams are welded at a rate of 6 to 8 ft. per min. A special roller bearing guide roll added to this machine keeps the welding rolls from digging into and cutting the shell of the tank while the seam weld is being made. As this welding operation progresses, a trunnion extension bearing is clamped at each

Final assembly operations, including the silver soldering of baffle screw heads, are performed on this 36-in. wide continuously moving belt conveyor originally used for assembling cooking stoves. Near the end of this conveyor the tanks pass through a booth where the outside surfaces are wire brushed

A soapy water solution is flowed over the exterior of each tank while the tank interior is filled with air under 10-lb. per sq. in. pressure. Bubbles show even the smallest leaks, which are marked for repair further along the line. Finished tanks are moved by overhead conveyors to the paint rooms and to final inspection stations

end of the tank so it can be lifted directly from the seam welder to a support cradle on the nearby final assembly belt conveyor.

On the constantly moving final assembly conveyor, the tanks are supported individually on wood cradles designed to permit the tank to be rotated about its longitudinal axis so that self-tapping screws can be driven through the skin and baffle overlaps to make a strong joint at each seam position. Also, other final assembly and silver soldering operations are performed as this belt conveyor carries the tanks through the shop. Near the end of this conveyor, which moves at the rate of 6 ft. per min., is an inclosed booth where the exterior surfaces of each tank are wire brushed to remove scratches and blemishes. As the belt conveyor moves the tanks out of the wire brushing booth, it delivers them onto a roller conveyor which transfers them automatically to the nearby leak test position.

Each tank is tested for leaks while still supported on its wood cradle, which makes it possible to turn the tank 360 deg. while inspecting the skin surface. At this position, the roller conveyor supports the finished unit over a drain tank, and a Gray-Mills pump unit flows a mixture of soapy water, containing about 5 percent soap, over the tank exterior at a rate of 5 gal. per min. Meanwhile, an air line fitted to one of the tank filler tubes maintains an air pressure of 10 lb. per sq.in. in the tank interior. Air escaping through leaks shows bubbles in the soapy water solution, and these leaks are marked for repair later.

Leaky Tanks Are Repaired

This method of testing for leaks is much simpler than when the tank must be submerged in a liquid bath, and it is more accurate than when testing is done by flowing a soap-water solution over the tank with paint brushes. There are more than 400 possible spots where leaks can occur in a 110-gal. tank. In normal production, better than 55 to 60 percent of the tanks have no leaks, and can go directly from the leak test position to the final paint conveyor lines. Leaky tanks are moved further along the roller conveyor to repair stations. After repairs have been made, the tanks are retested for leaks and then moved to the paint conveyor line.

In the paint lines, the interior of each tank first is coated with a special yellow fuel-resistant synthetic enamel while the tank is supported in a special tilting rack. For this operation, about 10-gal. of paint are poured into the interior of the tank and the filler and drain holes are plugged. Then an air motor rotates the tank at about 20 r.p.m. while the rack is tilted slowly through a 60-deg. angle by an air cylinder. After a 2-min. tilting cycle, the tank is drained for 5 min. and air is exhausted from the interior of the tank for 7 min. with a vacuum system. The tanks then are suspended from trunnion hooks on a power-driven overhead chain conveyor for movement to a degreasing station and to water-curtain type spray booths where the exterior surfaces are spray painted with aluminized varnish.

After spray painting, 110-gal. tanks are passed through an oven held at 300 F. The 15-min. trip through this oven results in a thoroughly dried surface on the exterior of the tanks. In the finishing line for 75-gal. tanks, the painted units are passed between banks of infra-red lamps for drying on a short cycle.

AMERICA WANTS PROSPERITY

A BOOK to be published early in April by the McGraw-Hill Book Company carries the provocative title "Prosperity: We Can Have It If We Want It." Its authors, Messrs. Shields and Woodward, state in vigorously challenging terms their conviction that the United States will emerge from war with human, material and technological resources adequate to provide a nation-wide standard of living unprecedented in world history. They present, too, their formulation of the several policies and procedures which must be followed by government, business, and labor if we are to realize our potential for a high and sustained prosperity unmarred by prolonged periods of severe unemployment and business stagnation such as have haunted our economic past.

The specific proposals set forth will elicit both enthusiastic acclaim and acrid dissent, for the book deals in far from gentle fashion with many of the currently fashionable panaceas for assuring prosperity by magic formula. It examines, and discards as effective guarantors of prosperity, whatever their individual merits upon other grounds, programs for public works, slum clearance, subsidizing of small business, foreign loans, social insurance, deficit government spending, redistribution of income, the numerous formulae for monetary management, repeal of the anti-trust laws, or any of the loosely-phrased admonitions that government should do nothing and allow everything to take its course untrammeled by controls of any kind.

On the positive side, the book urges clear recognition of the fact that prosperity, under a system of business enterprise, depends primarily upon the existence of competitive incentives that spur capital investment to provide better tools and equipment, that improve organization and technology to insure continuously increasing productivity per man-hour of work, and that enlarge markets by producing what the consumer wants at lower prices to the end that real incomes may be increased.

In short, prosperity depends upon profitable and expanding business and employment opportunity, so it becomes the part of enlightened government, business, agriculture and labor policy to promote those measures which will forward rather than retard the major aim of expanding production.

However great the room for dissent upon the adequacy, or the phrasing, of the specific recommendations it makes, the approach of this book has one virtue of solid merit. It attacks positively the problem of what steps should be taken to achieve and hold prosperity rather than merely devising a poultice to be applied when and if we run into a decline.

Virtually all responsible spokesmen for government, and for business, labor, and agricultural groups, are agreed upon the goal of prosperity. Moreover, they agree that, insofar as possible, it should be achieved through the effort of private enterprise, with government intervention utilized only as a last resort. But despite this unanimity, almost all public discussion of the problem has concentrated upon the nature, the extent, and the timing of such government expenditures as may be found necessary to combat deflation. Since upon this question there is far from general agreement, our procedure has created an exaggerated sense of divergence in a field in which, so far as fundamentals go, we all are in accord to quite an unusual degree.

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No confusion should be caused by the fact that the generally current phrase for prosperity is "full employment." The latter phrase merely states the goal in terms of human values, which are good terms in which to state any goal. What matters is that we generally are agreed as to what we mean when we say that we want prosperity or full employment. Not only do we know what we mean, but within very rough limits we can give dimension to our concepts. There are a few whose appraisals are somewhat lower, but most competent estimators set the goals for about 1950 at an average annual employment in civilian jobs of between 55 and 57 million persons, with a gross national product of between $185 and $200 billion measured at 1943 price levels. This contrasts with the 1944 level of non-military employed of 51½ million, and a gross output for the end of 1944 of over $200 billion. It assumes a reduction of the average workweek to 40 hours.

It will take some such levels as these to provide employment for those who seek work, with only sufficient "frictional" unemployment (those temporarily listed as unemployed because of the normal turnover between jobs) to afford reasonable labor-market flexibility to both workers and employers. The non-military employment figures are generally consistent with the officially stated postwar goal of jobs for 60 million workers, since the latter figure is generally understood to be an estimate of the *labor force,* which includes members of the armed services and an allowance for frictional unemployment.

There are a number of reasons why the estimates cannot be figured more closely, and why no one can be very confident even of the validity of the stated limits. The chief points of doubt in the employment estimates relate to how many withdrawals there are likely to be on the part of women, oldsters, and youngsters, who now are in the labor force to a number more than 6 millions beyond normal expectancy; how many men will be retained in the armed forces; and whether the

postwar frictional unemployment should be calculated as approximating the current 1 million or the 3 million so-listed in the prosperous year of 1929. Additional uncertainties cloud the estimates of gross national product. Notable among them is the fact that no one is sure of the war's effect upon man-hour productivity trends, in view of the fact that half of our current output has consisted of products that had no substantial counterpart in our peacetime price or production series.

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Nevertheless, despite such qualifications, it is fair to say that we do have a general conception of the magnitude of our postwar goals. Although they are well within our production potentials as demonstrated in this war, they are formidably beyond any previous record of peacetime achievement. Only the most sanguine optimism could lead one to expect that they will be achieved without concerted will, planning, and cooperative effort. Only blind recklessness could engender confidence that once attained they will automatically be held, let alone expanded in normally healthful growth.

If we were to follow past patterns, our war-built boom would, after a period of uncertain length, collapse into disastrous depression. The very magnitude of our recent growth would contribute to the depth and duration of the subsequent trough. Yet a fall even to the level of our previous peacetime-peak-year 1939, has been estimated by The Federal Reserve Board to imply unemployment for between 15 and 20 million persons. If human values have importance, that is something that must not be allowed to occur. If business values have importance, we must not tolerate again such losses as occurred from 1930 to 1933, when sales over the four year period were $128 billion less than would have been provided if the 1929 level had held, and corporate profits declined from more than $7 billions in 1929 to an average annual loss of $1 billion over the next four years. A repetition of these things cannot be tolerated—*if foresight and cooperative effort can prevent them.*

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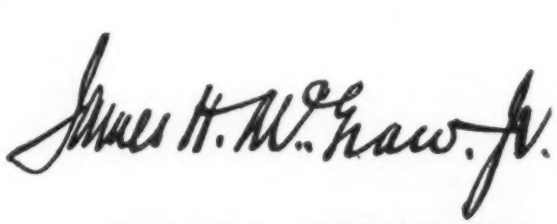
In January of this year Senator Murray introduced in the Senate a bill entitled "The Full Employment Act of 1945." It instructs the President to submit to Congress plans for eliminating both unemployment and inflation, including recommendations for correcting structural defects in the economic system. It provides for a Joint Congressional Committee to consider the proposals of the President, to take testimony from experts and the general public on these proposals or any others it may wish to consider, and after weighing all the facts to submit its findings to Congress. It provides for an advance budgeting of the constituent parts of a full-employment economy, and commits the Federal Government to provide, in advance, for sufficient expenditures (through private contractor channels) to make up for the gap between estimated private expenditures and the amount necessary to assure full employment.

By no stretch of the imagination can The Full Employment Bill, in its present form, be regarded as acceptable to business. Yet it may well present a test of whether or not American business can deal with problems in this area in a statesmanlike fashion. Such statesmanship will consist in demonstrating first, that the Bill is not acceptable because of deficiencies which preclude the possibility of its accomplishing the avowed purposes; and second, that business is able and anxious to offer constructive suggestions for remedying these deficiencies.

It is easy to point to weaknesses in the Bill. To mention only a few of major importance: The proposal to make advance Federal expenditures to compensate for estimated deficiencies in prospective private expenditures is completely impracticable. No one in the country can predict future trends with sufficient accuracy for this purpose; no one can tell what the constituent parts of a really high, *stable* peacetime budget should be, for in our boom-or-bust economy we have no stable pattern to project; no one can tell, within reasonable limits, how much the government should spend *in advance* to assure full employment. The Bill pronounces labor's right to work without defining commensurate responsibilities which it should exercise. It does not define the areas of proposed government expenditure in such a way as to allay business fears of government competition or the general public suspicion of leaf raking. Above all, the Murray Bill is defective in that, despite a somewhat vague pronouncement in favor of forwarding private business activity, it recommends a single specific designed to supplement such activity rather than stimulate it.

The very definition of certain of these faults suggests their remedies. But the positive task of stating how the Bill should be amended in order that it may have effective usefulness is far from simple. Yet it is enormously to the advantage of American business to undertake it. Fortunately, there is a representative group sponsored by industry, The Committee for Economic Development, which has for some time been working intensively upon the problem, and which is excellently equipped to offer sound and progressive advice. It should be used for this purpose.

American business cannot afford to take a negative attitude toward legislation in this field. Some legislation undoubtedly will pass, for the problem is one in which there is a grave government responsibility. But equally there is a comparably important responsibility upon all citizen groups. None of them has more to gain or lose from the rise or fall of prosperity than American business.



President, McGraw-Hill Publishing Co., Inc.

THIS IS THE 34TH OF A SERIES

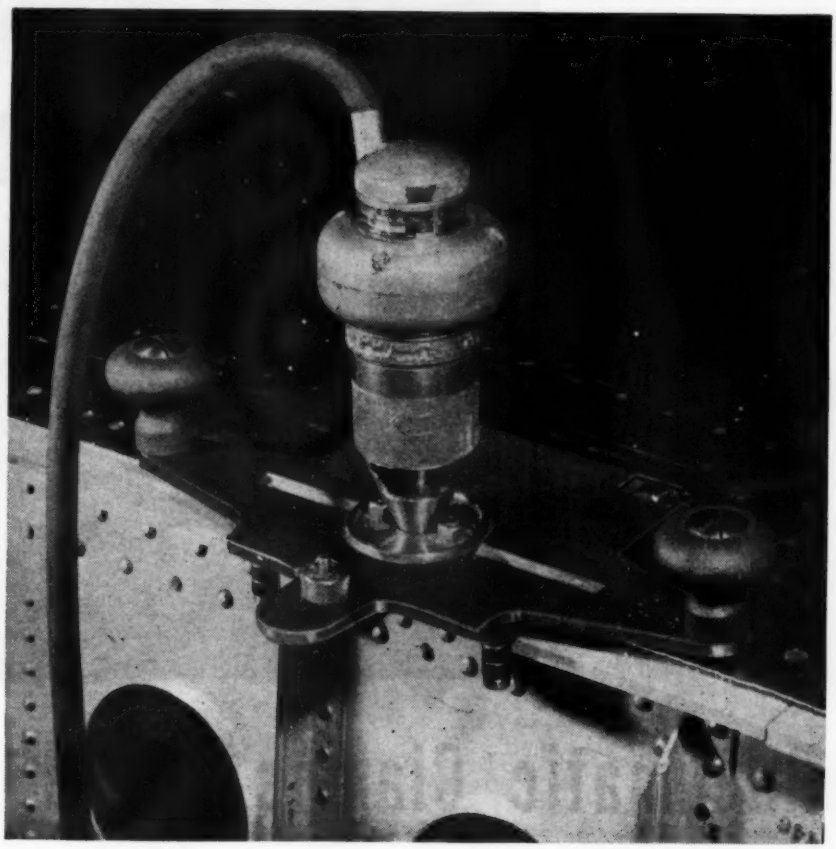
Guide Attachments Used on Wing Sections

BY C. G. SHUNATONA AND G. W. WRIGHT
WICHITA DIVISION, BOEING AIRPLANE COMPANY

Device attached to pneumatic hand router permits accurate trimming of skin sheets and eliminates marring of surface

THE CAREFULLY streamlined wing and fuselage sections for the B-29 Superfortress bombers being made at the Wichita Division plant of the Boeing Airplane Company make necessary a number of butt joints in the skin assembly. These skin joints must be accurate so that the mating subassemblies will join accurately as the huge plane is put together, and so that the entire skin area will present a smooth surface. In assembling the main wing sections, it is necessary to trim the skin along the front of the outboard wing spar so that the mating subassembly will butt tightly against this skin section.

Originally, this skin edge was trimmed with handsnips and then smoothed up with hand files after the skin had been riveted to the spar chords. These operations inevitably resulted in scored and marred wing surfaces. A neater, more accurate job now is done with a pneumatic hand router equipped with a special guide attachment as shown in the accompanying illustrations. The tool is guided from the edge of the wing spars by rollers projecting vertically downward from the attachment. Three horizontal rollers under the attachment plates guide the cutter so that it always cuts the wing skin sheets to the proper depth. One of these rollers rides on the top of the wing's spar while the other two rollers ride on the top of the skin surface. With this tool one man can do in a few minutes what formerly took several men hours to accomplish.



A small pneumatic router mounted vertically on an attachment plate trims the skin of this wing section parallel with the forward edge of the wing spar. An adjustable guide permits positioning the cutter accurately with relation to the forward edge of the spar so that a correct depth of cut is maintained

Under the attachment plates are three horizontal rollers and two vertical rollers which guide the cutter accurately with relation to the forward edge of the wing spar and the top surfaces of both the spar and the wing skin sheet. The rapidly rotating cutter produces a smoothly trimmed edge

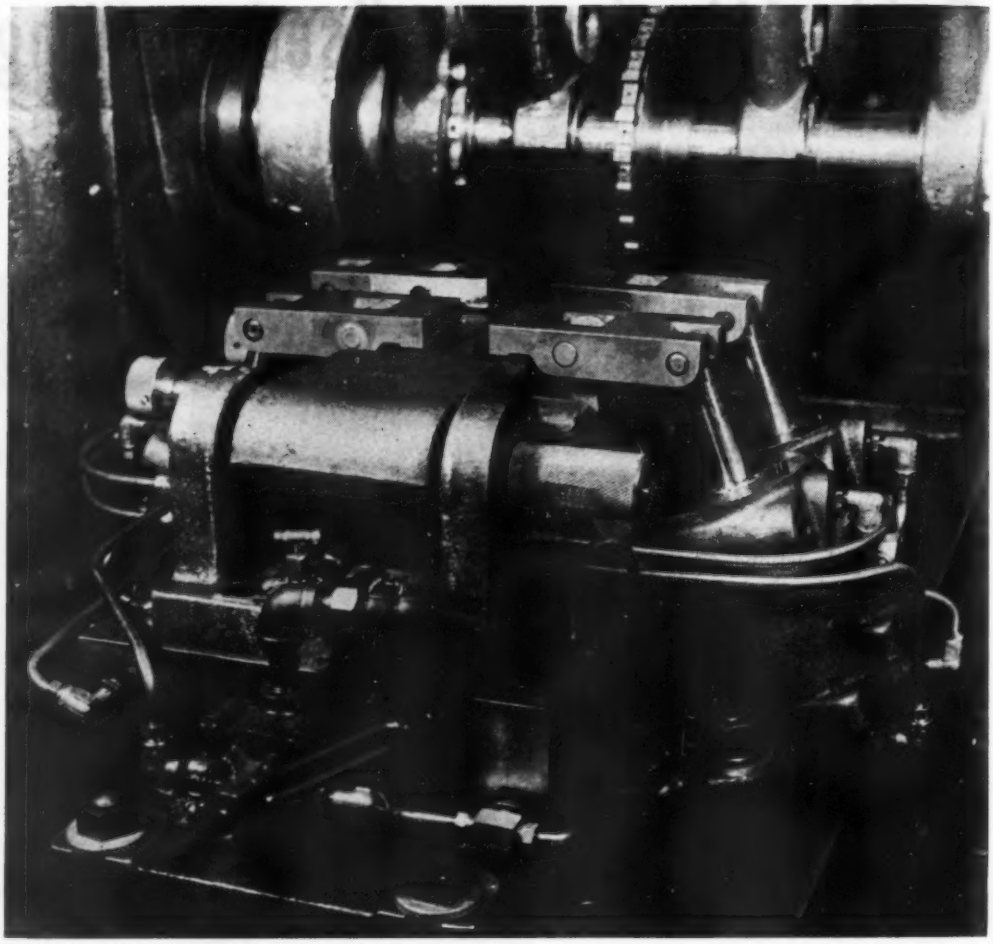


Fig. 1—Loading time for this milling set-up was cut from 300 to about 40 sec. when the air-operated fixture replaced a manually operated fixture. Two clamping cylinders are employed on each side of this unit

Pneumatic Clamps Speed Slotting Of Aircraft Wing Hinges

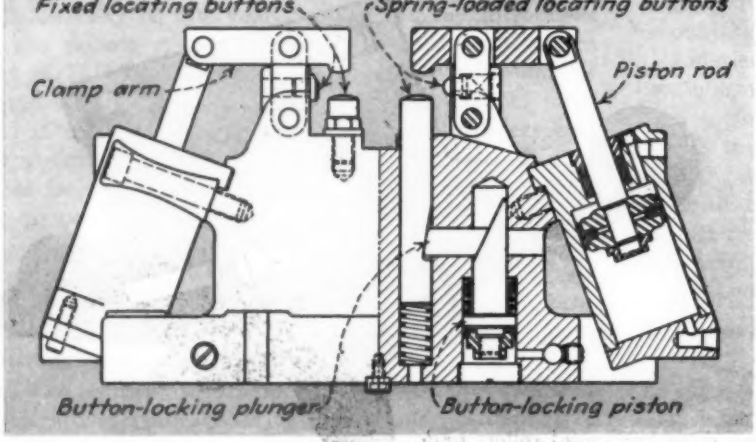


Fig. 2—Four different fixtures were necessary to permit milling four sizes of forged steel aircraft wing hinges. This unit, for one of the larger hinges, has three air clamps on each side. The Meehanite base casting provides adequate support for the slotting cut

Substantial savings in set-up time have been realized through replacement of manual holding fixtures by air-operated types

NOTABLE time economy has been effected by Kearney & Trecker Corporation of Milwaukee, Wis., in the slotting of SAE 4340 forgings heat-treated to a Brinell hardness of 357 to 390. Four sizes of wing hinges for carrier-based aircraft are being slotted with carbide-tipped milling cutters which have supplanted high-speed steel cutters with a resultant saving of 95 percent in time required for machining. Additional speed has been gained by re-

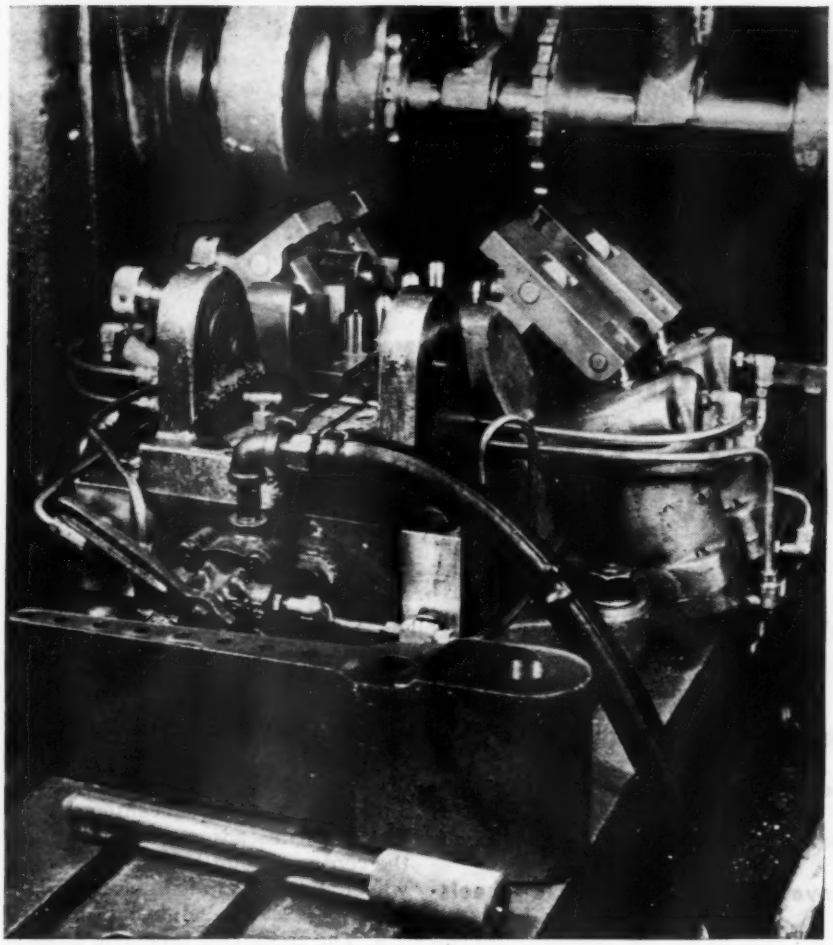


Fig. 3—A single movement of the air-valve control lever opens or closes the air operated clamps on this milling fixture. An unslotted hinge forging is shown in the foreground

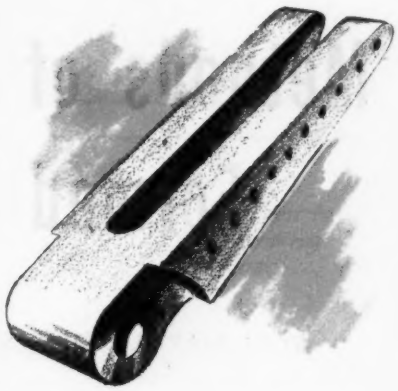


Fig. 4—This aircraft wing hinge is made from a forging of SAE 4340 steel that is heat-treated to a hardness of about 357-390 Brinell before machining. The slot is milled with a 24-tooth, 10-in. diameter cutter having wedge-type carbide tips set to give a 15-deg. negative face angle

placing manual holding fixtures with air-operated clamps which reduce set-up time from five minutes to forty seconds.

The slot, 0.505 in. wide, and 10.5 in. long formerly was completed at the rate of 2.5 pieces per hr. The new method has increased production to 16 pieces per hr. A single air control valve actuates all clamping cylinders including the pneumatic support buttons which hold the forging without distortion during the slotting operation. Transverse location of the wing hinge is accomplished by two fixed buttons in one side and spring-loaded pins on the opposing side. A steel pin through hardened steel bushings locks the hinge in the fixture.

COMPARISON OF SLOTTING OPERATION ON WING HINGES

	Std. HSS Cutter	Wedge-Type Carbide Cutter
Cutting time	20 min.	0.92 min.
Loading time, manual	5 min.	——
Loading time, pneumatic	——	40 sec.
Pieces per grind	11.2	32.3
Pieces per hour	2.5	16
Cutter sharpening time	25 min.	48 min.
Cutter cost per hinge	77 cents	17 cents
Wheel cost per hinge	7 cents	5 cents

NOTE: The high-speed steel cutter can be sharpened only ten times. After sixteen grinds, the carbide cutter can be fitted with new tips.

The 18-tooth high-speed steel cutter was 8 in. in diameter and used a feed of ½ in. per min. at 25 r.p.m. The new cutter, 10 in. in diameter, has 24 wedge-shaped carbide tips set at 15 deg. negative rake and zero helix angle. The cutting feed is 10.5 in. per min. at 224 r.p.m.

Cutting time was reduced from an average of 20 min. per piece with the high-speed steel cutter to about 55 sec. per piece with the carbide tipped cutter. Pieces per cutter sharpening averages 32.3 with the carbide-tipped cutter as against 11.2 pieces per grind with a high-speed steel cutter.

Because of variations in the size and shape of the four wing hinges, it was necessary to build four different air-operated fixtures for slotting the pieces. The four fixtures are essentially the same in basic design, the one for short hinges having two air cylinders on each side to operate clamp arms while the larger fixtures have three air cylinders on each side.

The saving in set-up and machining time by the new method quickly amortizes the investment in automatic clamping fixtures and high-speed carbide milling tools.

Methods of Sharpening Peripheral and Formed Profile Milling Cutters

BY M. MARTELLOTTI, RESEARCH ENGINEER, CINCINNATI MILLING MACHINE COMPANY

TOOL LIFE and effective cutting action are directly dependent on proper sharpening practice. The last installment of this series explained general methods of handling milling cutters and the influence on clearance angles of disk- and cup-type abrasive wheels. Detailed procedure is the next consideration.

In the tenth installment of his series, the author gives some practical pointers on the use of several types of abrasive wheels

The procedure in sharpening peripheral milling cutters when the *clearance setting dial* is used follows:

1. A cup or a disk wheel of the proper grit and grade is placed on the wheel spindle. The rim of the wheel is dressed by a diamond dresser to one of the shapes illustrated in Fig. 51.

2. The center of rotation of the grinding wheel is then brought into line with the center of the cutter. For this purpose a centering gage is placed on the table with the upper part of the gage projecting toward the wheelhead as shown in position in Fig. 52. The wheelhead is raised or lowered by operating a handwheel until the zero line stamped on one side of the wheelhead or the center hole on the threaded end of the spindle lines up with the gage plate. Since the distance between the base and the gage plate in the centering gage is equal to the height of the center line of the cutter mounted on tailstock centers above the table, this adjustment will place the center of rotation of the grinding wheel and the center line of the cutter at the same height.

3. The tooth rest holder is mounted on the wheelhead. The blade is located in front of the rim but below the center of rotation of the grinding wheel.

4. The left- and right-hand tailstocks are now placed in position on the table at a distance corresponding to the length of the arbor used for supporting the cutter between centers, Fig. 53.

5. The clearance setting dial unit is mounted on the left-hand tail-

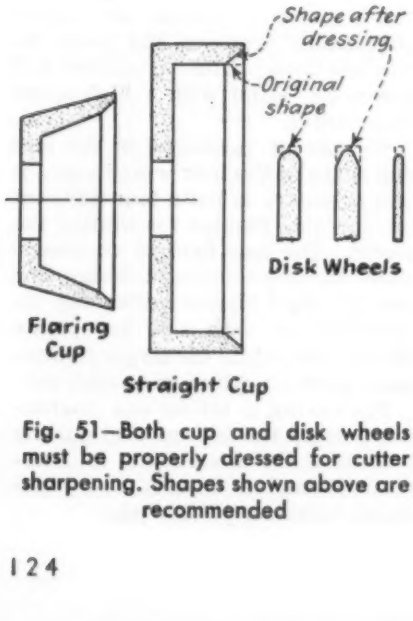


Fig. 51—Both cup and disk wheels must be properly dressed for cutter sharpening. Shapes shown above are recommended

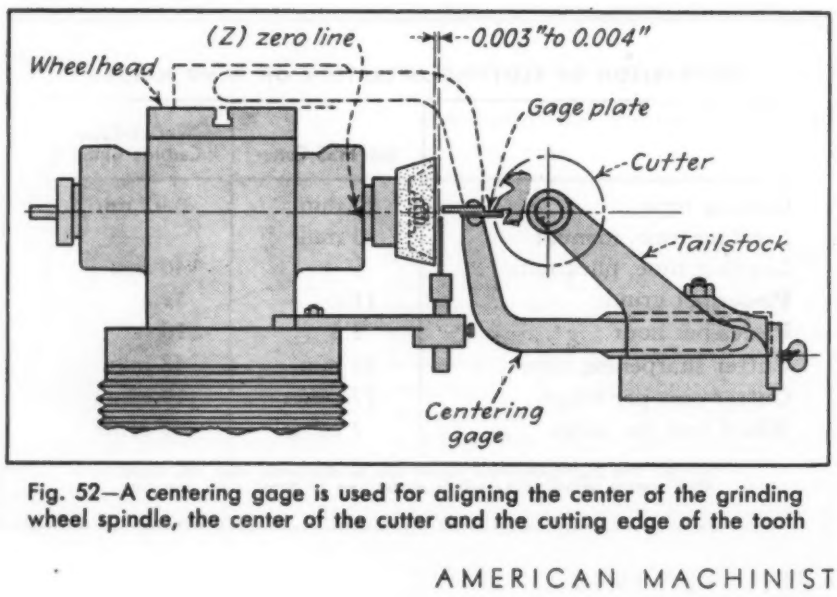


Fig. 52—A centering gage is used for aligning the center of the grinding wheel spindle, the center of the cutter and the cutting edge of the tooth

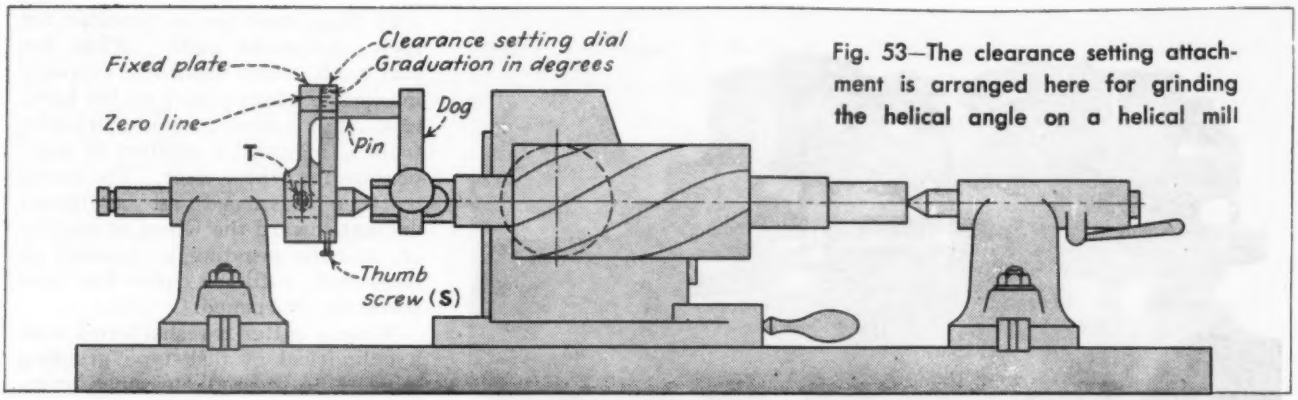


Fig. 53—The clearance setting attachment is arranged here for grinding the helical angle on a helical mill

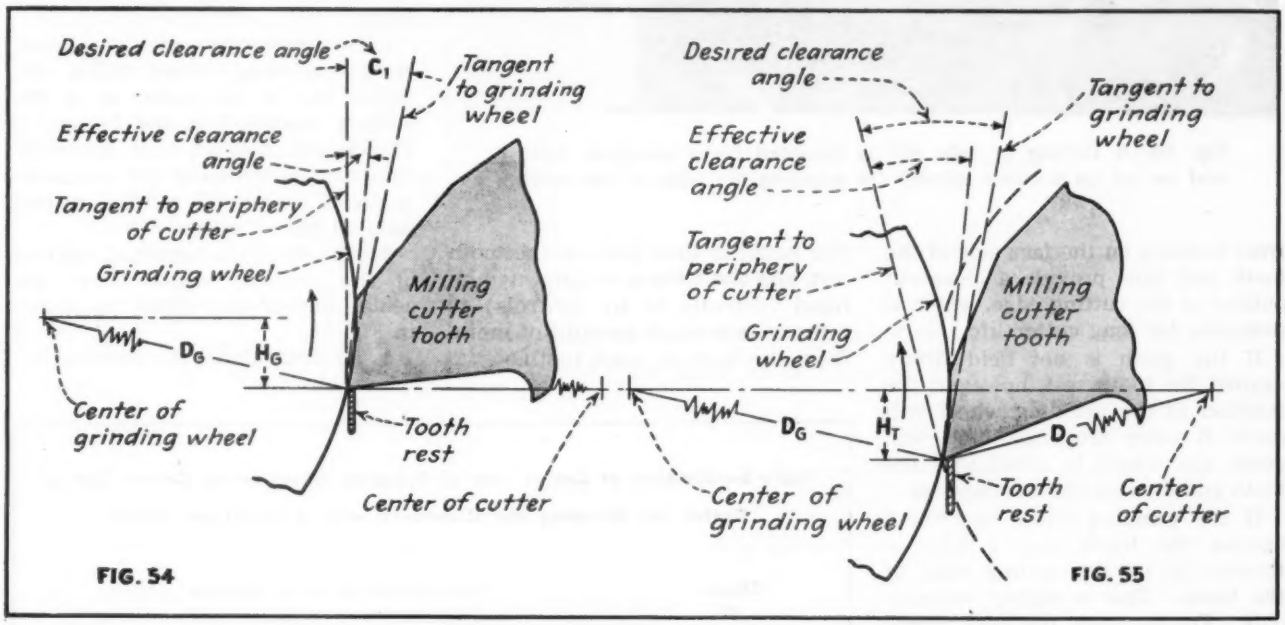


Fig. 54—The clearance angle can be ground with a disk-type grinding wheel by setting the center of rotation of the grinding wheel above the center line of the cutter. Fig. 55—Another method of grinding the clearance angle is to maintain the center of the cutter in line with the center of rotation of a disk-type grinding wheel and lowering the tooth rest

stock. It consists of the *fixed plate*, the *dial* and the *dog* provided with a *pin*. The fixed plate has a zero mark stamped on it, and the dial has graduations in degrees of the clearance angle.

6. The cutter and *clearance setting dog* are now placed on the arbor. The arbor is mounted between centers and the pin is inserted in the hole provided on the clearance setting dial, Fig. 53.

7. The clearance setting dial is rotated until the zero mark of the graduation in degrees lines up with the zero mark on the fixed plate, then it is clamped to the fixed plate by means of the thumb screw *S* shown in Fig. 53.

8. The centering gage is set on the top of the wheelhead in front of the rim of the grinding wheel. By operating either handwheel, the cutter is moved toward the plate of the centering gage. The point where the tooth contacts the gage plate is marked so that it can be returned in the same position if accidentally moved. In this operation, the tooth is brought in line with the center of rotation of the wheel and the center line of the cutter.

9. The fixed plate is clamped to the tailstock by means of the screw *T* indicated in Fig. 53.

10. The cutter is now moved toward the wheelhead until the cutting edge is very near the rim of the grinding wheel. The table is moved so as to place the mark on the tooth in front of the rim of the grinding wheel.

11. The tooth rest is moved to contact the tooth, and it is then clamped in position. The tooth rest blade should support the tooth being ground, and should be located as near as possible to the cutting edge of the tooth in front of the wheel.

12. While holding the tooth in contact with the tooth rest, and after releasing the clearance setting dial by loosening the thumb screw *S*, the wheelhead is lowered by operating a handwheel until the desired clearance angle is read on the clearance setting dial opposite to the zero mark on the fixed plate. The clearance setting dog can then be loosened.

13. When grinding the clearance with a cup-type wheel, the wheelhead should be displaced by a small angle (about 1 deg.), so as to avoid contacting the cutter with the opposite side of the rim.

14. Now the machine is ready for grinding the clearance angle on the cutter. The direction of rotation of the grinding wheel should be *against the cutting edge* (toward the face of the tooth and away from the tooth rest). This will prevent burrs

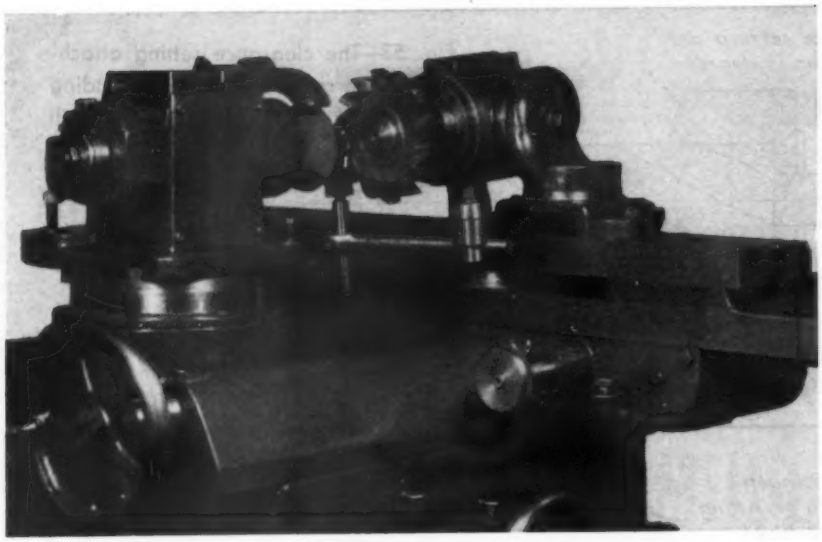


Fig. 56—A slotting or side mill is mounted on a universal head and set up on a cutter grinder for grinding the sides of the teeth

from forming on the face side of the tooth and thus provide a clean-cut outline of the cutting edge, which is desirable for long cutter life.

If the tooth is not held firmly against the tooth rest, however, the rotation of the grinding wheel will move it away from it. This will cause the wheel to grind into the tooth and damage the cutting edge.

If the grinding wheel is rotated against the tooth rest, a burr is thrown up on the cutting edge of the tooth. This is highly undesirable. Furthermore, the heat generated in grinding tends to burn the cutting edge.

15. To establish contact, the cutter is moved toward the grinding wheel by operating either handwheel. Then it is displaced sideways so as to place it away from the grinding wheel. This is done by moving the table by hand, by knobs or by crank.

16. By subsequently operating the handwheel the saddle supporting the cutter is moved in the desired feed per pass toward the grinding wheel. The cutter is then held on the tooth rest, and the table is reciprocated by hand (directly or by controls) to remove this small amount of metal from the back of each tooth.

17. This operation is repeated for each subsequent tooth. When the first tooth, which should be properly marked, is again placed on the tooth rest, the diametrically opposite tooth is indexed in position to compensate for wheel wear. The cutter is then advanced an additional amount toward the wheel as required, and the grinding is repeated on each tooth until the cutter has been correctly sharpened.

When a cutter is resharpened with a cylindrical or disk-type grinding wheel, the desired clearance angle can be obtained in three different ways:

1. By setting the center of rotation of the grinding wheel below the center line of the cutter as in the method described in the foregoing. This is the method most generally employed in grinding the clearance angle of peripheral milling cutters such as helical mills.

2. By setting the center of rotation of the grinding wheel above the center line of the cutter, as shown in Fig. 54.

3. By maintaining the center of ro-

Table 6—Distance of Center Line of Grinding Wheel Below Center Line of Cutter for Grinding the Clearance with a Disk-Type Wheel

Diam. of Cutter D, in Inches	Clearance Angle C in Degrees:									
	1	2	3	4	5	6	7	8	9	10
	Distance H, in Inches:									
2	.017	.035	.052	.070	.087	.104	.122	.139	.157	.174
3	.026	.052	.078	.104	.131	.157	.183	.209	.235	.261
4	.035	.070	.104	.139	.174	.209	.244	.278	.313	.348
5	.044	.087	.131	.174	.218	.261	.305	.348	.392	.435
6	.052	.104	.157	.209	.261	.313	.365	.418	.470	.522
7	.061	.122	.183	.244	.305	.365	.426	.487	.548	.609
8	.070	.139	.209	.278	.348	.418	.487	.557	.626	.696
9	.078	.157	.235	.313	.392	.470	.548	.626	.705	.783
10	.087	.174	.261	.348	.435	.522	.609	.696	.783	.870

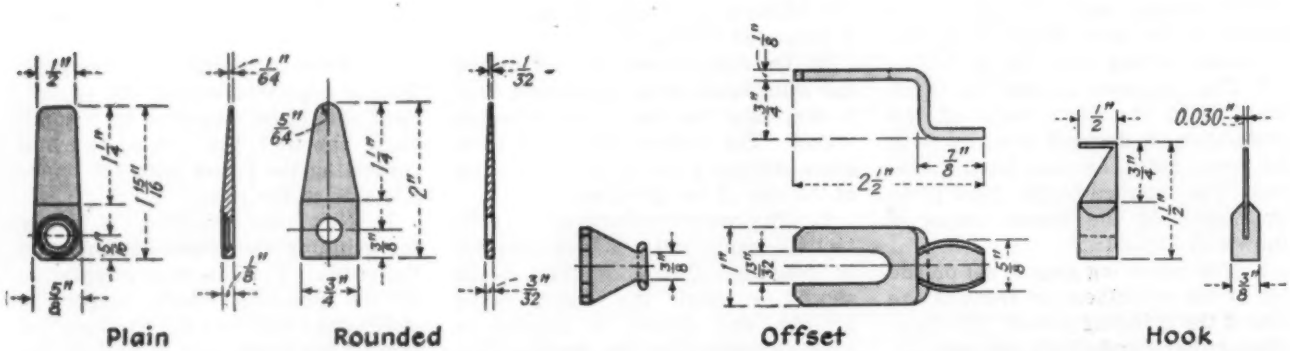


Fig. 57—Here are four types of tooth rest blades: plain, round, offset and hook

tation of the grinding wheel in line with the center of the cutter and lowering the tooth rest, as shown in Fig. 55.

The vertical distance H necessary to produce the required clearance can be computed with Formula 12 (see previous installment), while in the case of Figs. 54 and 55 it can be computed by means of the following formulas:

$$H_g = 0.0087\ D_g C_1 \qquad (14)$$

$$H_t = 0.0087\ \frac{D_g D_c}{D_g D_c}\ C_2 \qquad (15)$$

where:

H_g, H_t = the vertical distance in inches between center of rotation of grinding wheel and tooth rest, and the distance between line through center of grinding wheel and cutter and the tooth rest.

D_c, D_g = diameter of cutter and grinding wheel respectively.

C_1, C_2 = the clearance angle in degrees.

Depending on the method used for obtaining the clearance angle, H increases with the diameter of the grinding wheel, the diameter of the cutter and the value of the clearance angle, and it can be read directly in Tables 6, 7 and 8, which follow.

The values of H which are given in Tables 6, 7 and 8, apply in the cases of plain milling cutters such as helical mills and slotting cutters with either straight or helical teeth mounted on a shaft and supported between centers; for grinding the sides of side mills Fig. 56, or the face of shell end mills mounted on a universal head; and for end mills held on a special steel arbor.

The proper and correct sharpening of peripheral milling cutters depends to a great extent on the observance of the following rules:

1. The proper grit and grade of grinding wheel of the cup or disk-type should be used, having the periphery dressed with a diamond dresser to one of the shapes illustrated in Fig. 51.

2. The tooth rest should be located as near as possible to the cutting edge. For ordinary sharpening operations on, for example, a high-speed steel helical mill, the distance recommended is 0.003 to 0.004 in. See Fig. 52.

3. The tooth rest should be located on the face of the tooth being ground.

4. Tooth rest blades are made of steel, and are most commonly used in the shapes and dimensions shown

Table 7—Distance of Center Line of Grinding Wheel Above Center Line of Cutter for Grinding the Clearance with a Disk-Type Wheel

Diam. of Grinding Wheel D_g in Inches	Clearance Angle C_1 in Degrees									
	1	2	3	4	5	6	7	8	9	10
	Distance H_g in Inches:									
3	.026	.052	.078	.104	.131	.157	.183	.209	.235	.261
4	.035	.070	.104	.139	.174	.209	.244	.278	.313	.348
5	.044	.087	.131	.174	.218	.261	.305	.348	.392	.435
6	.052	.104	.157	.209	.261	.313	.365	.418	.470	.522
7	.061	.122	.183	.244	.305	.365	.426	.487	.548	.609
8	.070	.139	.209	.278	.348	.418	.487	.557	.626	.696
9	.078	.157	.235	.313	.392	.470	.548	.626	.705	.783
10	.087	.174	.261	.348	.435	.522	.609	.696	.783	.870

Table 8—Distance of Tooth Rest Below Center Line of Grinding Wheel and Cutter for Grinding the Clearance Angle with a Disk-Type Wheel

Diam. of Cutter D_c in Inches	Grinding Wheel Diameter D_g = 3 Inches Clearance Angle C_2 in Degrees:									
	1	2	3	4	5	6	7	8	9	10
	Offset H_t in Inches:									
2	.010	.020	.030	.040	.050	.060	.070	.080	.090	.100
3	.013	.026	.039	.052	.065	.078	.091	.104	.117	.131
4	.014	.028	.041	.055	.069	.081	.097	.110	.124	.138
5	.016	.032	.049	.065	.081	.097	.113	.130	.146	.162
6	.017	.035	.052	.070	.087	.104	.121	.139	.157	.174
7	.018	.036	.055	.073	.091	.109	.127	.146	.164	.182
8	.019	.038	.057	.076	.095	.113	.132	.151	.170	.189
9	.0196	.039	.059	.078	.098	.118	.137	.157	.176	.196
10	.020	.040	.060	.080	.100	.120	.140	.160	.180	.200

Grinding Wheel Diameter D_g = 6 Inches

Diam. of Cutter D_c in Inches	Clearance Angle C_2 in Degrees:									
	1	2	3	4	5	6	7	8	9	10
	Offset H_t in Inches:									
2	.013	.026	.039	.052	.065	.078	.091	.104	.117	.131
3	.017	.035	.052	.070	.087	.104	.121	.139	.157	.174
4	.021	.042	.062	.083	.104	.125	.146	.166	.187	.208
5	.023	.047	.070	.094	.117	.140	.164	.187	.211	.234
6	.026	.052	.078	.104	.131	.157	.183	.209	.235	.261
7	.028	.056	.084	.112	.141	.169	.197	.225	.253	.281
8	.029	.060	.089	.119	.149	.179	.209	.238	.268	.298
9	.031	.063	.094	.125	.157	.188	.219	.250	.282	.313
10	.033	.065	.097	.130	.163	.196	.228	.261	.293	.326

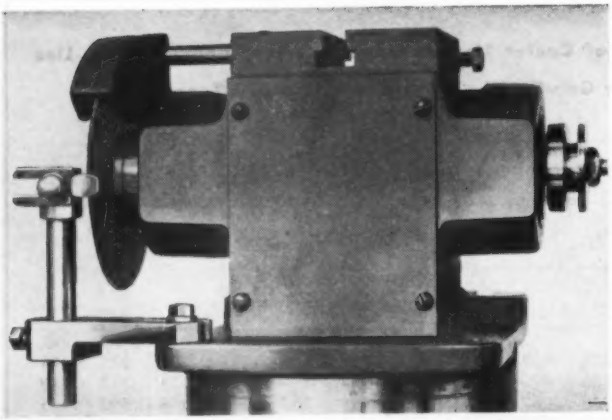
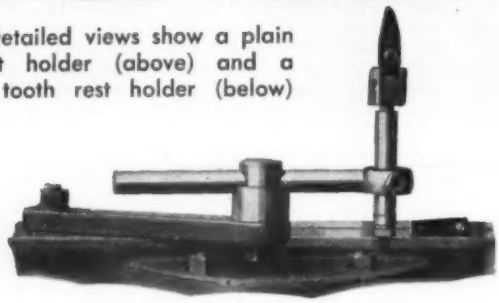


Fig. 58—Detailed views show a plain tooth rest holder (above) and a universal tooth rest holder (below)



in Fig. 57. The *plain tooth rest blade* is used with straight-tooth milling cutters, while the *rounded tooth rest blade* is employed for cutters having the teeth on a helix. The *offset tooth rest blade* is a universal type suitable for most applications. The *hook tooth rest blade* is used with cutters of small diameter such as end mills and slotting cutters where because of the spacing of the teeth, the tooth rest blade cannot be located below the grinding wheel and cutter, as is usually done with cutters of larger diameter.

Other shapes of tooth rest blade are also possible, as dictated by special types of cutters or the design of the particular cutter grinder being used.

Holders for the tooth rest blade may be either *plain* as in Fig. 58 (above) or *universal* (below). The universal tooth rest holder is provided with a micrometer adjustment for obtaining small up-and-down movements in the final setting of the blade.

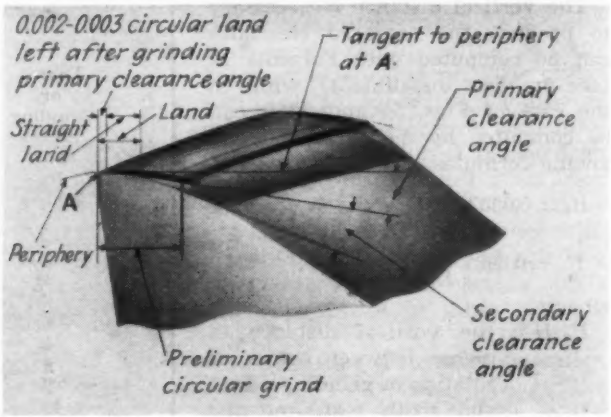
5. In order to eliminate tedious checking of each tooth, peripheral milling cutters of the profile type should be ground by first providing a small *circular land* near the cutting edge.

This can be done by first setting the cutter between centers to true up the diameter, and then cylindrical grinding a small land not over 1/64-in. in width on the flank of the tooth back of the cutting edge.

When this operation has been completed, the cutter can be set up for grinding the clearance angle. The operator should closely observe the gradual elimination of the cylindrical land, and when this land is barely visible, the grinding operation is completed. On the back of the cutting edge will be left a small cylindrical land of approximately 0.002 to 0.003 in. in width, as is shown enlarged in Fig. 59.

The same procedure is repeated for each tooth. By following this method in resharpening cutters such as helical mills, it is possible to obtain true-running teeth and better cutter performance with a minimum of time and effort. This will also aid in overcoming the effect of too large a clearance angle on cutter performance.

Fig. 59—An enlarged outline shows a plain milling cutter tooth ground with a small circular land on the clearance side



The procedure followed in sharpening a formed profile-type milling cutter is similar to that used in sharpening peripheral milling cutters of simpler outline, such as plain milling cutters, helical mills, end mills and side mills.

Because of the complicated outline of the tooth, however, it is sometimes difficult to perform the resharpening operation with the required accuracy. This condition may be improved considerably by using gages which permit checking the contour as it is ground.

Part 11 of Mr. Martellotti's series, describing the sharpening of face mills and form-relieved milling cutters, will appear in an early number.

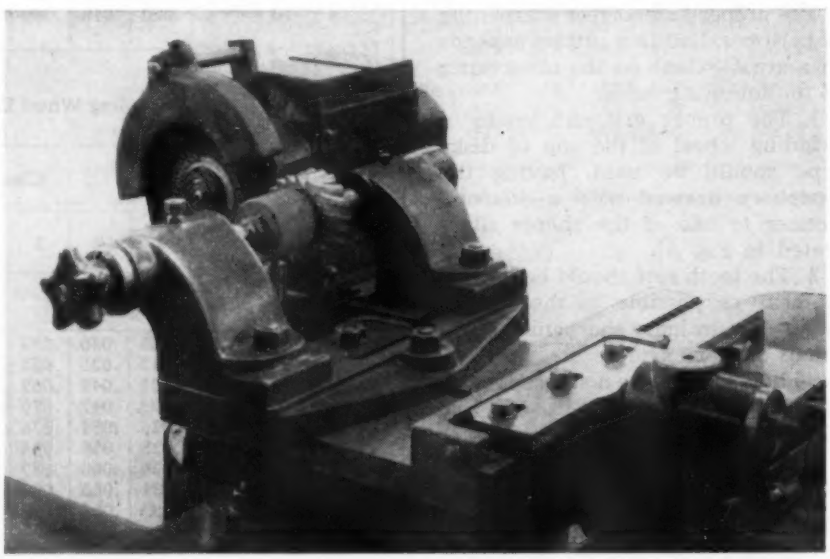


Fig. 60—This attachment is used for sharpening formed profile cutters

Practical Ideas

War-Winning Suggestions appearing here were recognized as meritorious by the Board for Individual Awards, War Production Drive, and the Navy Employees' Suggestion Program. They are offered to industry to aid in war production

Combined Reamer and Tap Adjusted By Three-Step Tapered Mandrel

BY ALBERT SUMMERS

Bomb-bay doors for the B-29 Superfortress are operated by large nuts tapped with a 1½-in. 16 NS, Class 3 thread. The Boeing Airplane Company, Wichita Division, has developed a combination reamer and tap for making them.

There are four reamer blades for sizing the hole to the thread root diameter, four roughing thread chasers, followed by six finishing thread chasers.

The backs of each set of blades have a taper of one inch per foot, to correspond with the mandrel. These blades are held in position in the body by two setscrews placed at a 45-deg. angle to the ends of the blades; they jam the blades against the mandrel and prevent movement once adjustment has been made.

All adjustment is by moving the tapered mandrel. Under each set of blades is a tapered section, otherwise the shape is cylindrical. The top end of the mandrel is threaded and this end has a hexagonal socket.

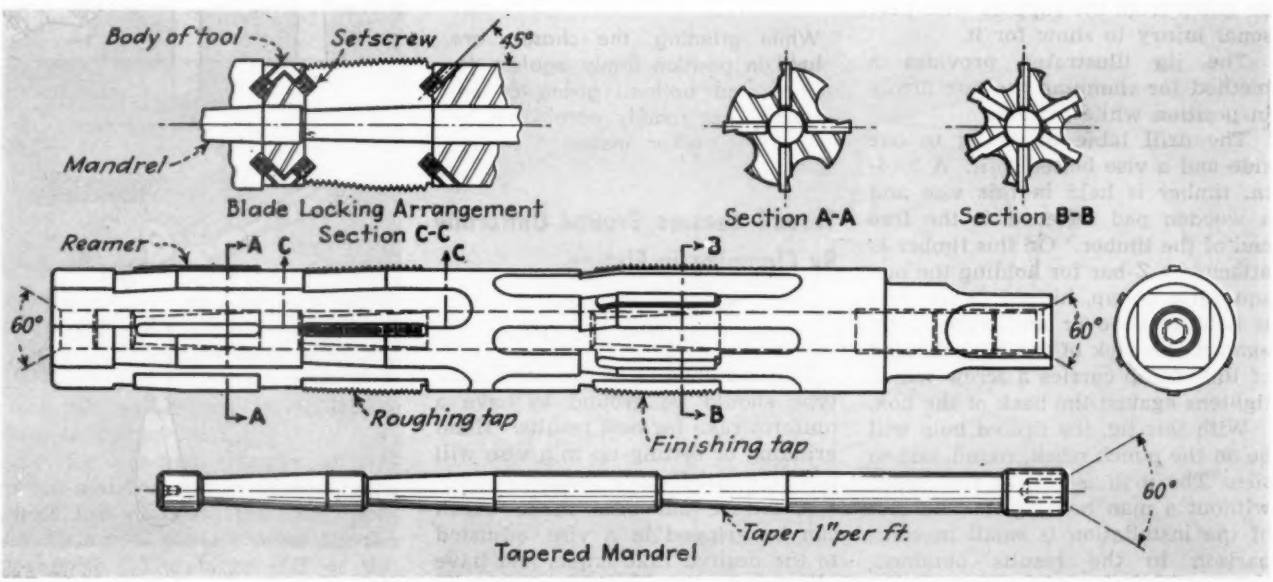
The tool body is cylindrical, except the top where, for ease of operation, a square head is milled. To act as a pilot, the bottom of the body is ground to the rough size of the hole. At the reaming and tapping position, chip flutes and blade slots are milled. A hole through the body provides room for the tapered mandrel; at each end of this hole there is a 60-deg. countersink for centers. The top of this hole is tapped to adjust the taper mandrel and a socket-head setscrew locks the mandrel.

The space between the threaded blade sections is longer than the chasers so that only one set of chasers is cutting threads. The roughing chaser has a long tapered section to start the threads in the reamed hole; the finishing chaser has a short tapered section to register with the rough threads correctly before beginning the finishing cut.

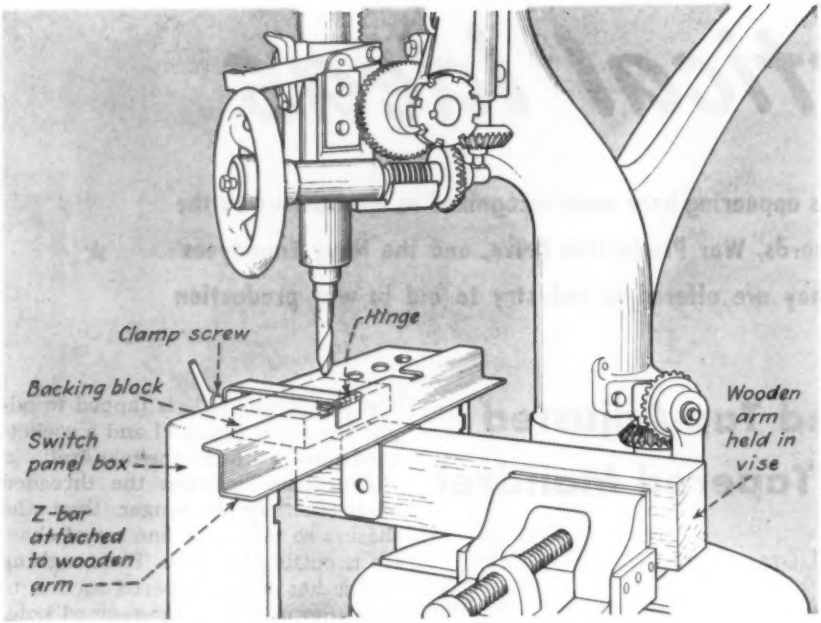
Great accuracy is expected, so the reaming and threading blades are ground in assembly.

The body is made of SAE 4130 steel, heat-treated to a tensile strength of 180,000-200,000 lb. per sq. in. The mandrel is made of tool steel hardened to about 63-64 RC.

The reamer, roughing, and finishing blades are honed at assembly for a slip fit into the body slots. They must fit the slots within plus or minus 0.0005 in. on the sides and within plus 0.000 in. and minus 0.0013 in. on the ends.



This expanding tool incorporates a reamer, a roughing tap and a finishing tap for a 1½ in.-16-NS-3 tapped hole in one end of the large screw which is part of the bomb-bay door mechanism on the B-29 bomber. All cutters at the three stations are expanded at once



This jig holds the switch panel box firmly. The holes are drilled on center and to size at a speed not possible when held by hand

Drilling Jig for Holding Steel Switch Boxes

BY WILLIAM D. DISHMAN
Permanente Metals Corporation,
Shipyard Number One,
Richmond, Calif.

Conduit penetrations in sheet-metal switch boxes have been drilled with much dissatisfaction and discouragement; seldom were the holes round or in the intended location, only too often they had to be filed to fit the conduit; also, when the drill broke through, the box would be taken from the support with personal injury to show for it.

The jig illustrated provides a method for clamping the box firmly in position while drilling.

The drill table is swung to one side and a vise bolted to it. A 2×4-in. timber is held in this vise and a wooden pad fastened to the free end of the timber. On this timber is attached a Z-bar for holding the box square; a clamp, hinged to the bar, is bent to go over and come down against the back of the box; the end of this clamp carries a screw which tightens against the back of the box.

With this jig, the drilled hole will be on the punch mark, round, and to size. The drill is run at full speed without a man holding it. The cost of the installation is small in comparison to the results obtained, without counting the avoidance of personal injury. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*

While grinding, the chasers are held in position firmly against the back and bottom, giving a uniformity not readily obtainable by other means

Thread Chasers Ground Uniformly By Clamping in Fixture

BY GUY E. RUSSELL
San Diego Naval Air Station

Diehead chasers of the Landmatic type should be ground to have a uniform rake for best results. Hand grinding or setting-up in a vise will not give satisfactory results.

A fixture has been made which can be gripped in a vise, adjusted to the desired rake angle, and have all chasers alike.

A piece of steel has a shoulder machined on each side, so that right- and left-hand cutters can be sharpened. To hold the chasers firmly against the shoulder, a clamp bears upon the threads so that, as the screw is tightened, the chaser is forced downward on the shoulder and toward the side of the fixture.

With the chaser held in this position, grinding will shape the cutting edges uniformly. The result is correctly formed threads because all cutting edges are actively removing metal.

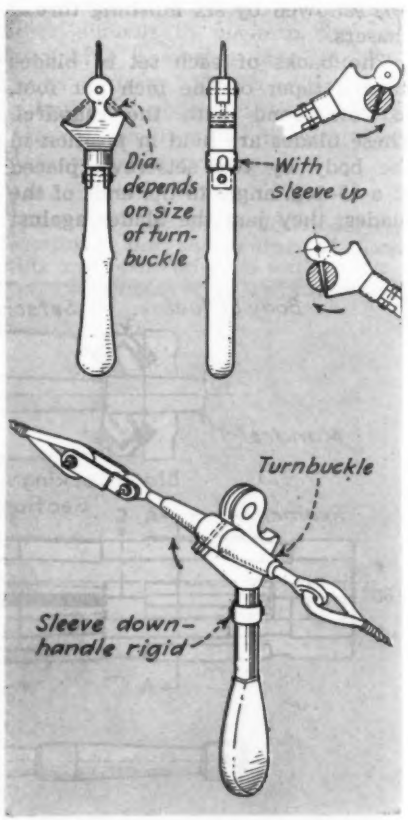
This method produces chasers exactly alike and saves considerable time. *Suggestion submitted under the Navy Employees' Suggestion Program.*

Aircraft Turnbuckle Wrench Proves a Time Saver

BY MILTON F. CARIS
Navy Yard, Moffet Field, Calif.

Various means for adjusting turnbuckles have not always proved satisfactory; some tools fall off too readily, others are just too inconvenient to use.

To prevent slippage, a wrench with a pin to fit into the hole in the



Value of this wrench lies in its self-locking principle and convenience of operation. Very few parts are necessary to assemble it

middle of the turnbuckle is easier to operate that the customary tools; if a locking feature is added, then adjustment is positive and continuous. Construction of the wrench includes a hinged pin, a head, and the handle hinged to the head.

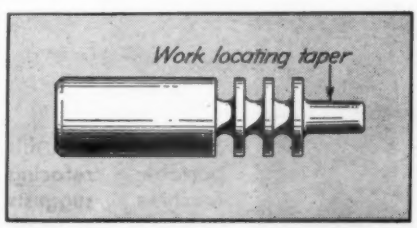
One end of the hinged pin fits the hole in the turnbuckle, the hinged end is attached to the head by a pin; the head is shaped so that when it is swung either to the right or left, the body of the turnbuckle fits into curved recesses; the handle is hinged to the head for passing conveniently through cramped spaces. To make a rigid connection between the head and the handle, a loose sleeve is slipped over the hinged joint.

After the pin is placed in the turnbuckle hole, movement of the handle in either direction locks the wrench in position and prevents the handle from twisting; the pin cannot come out until the handle is straightened. *Suggestion Submitted Under the Navy Employees' Suggestion Program.*

Air-Cooled Mandrel Promotes Accurate Production

BY OMER COTY
Ford Instrument Company, Inc.,
Long Island City

When turning large quantities of non-ferrous metal pieces on a mandrel, the spindle becomes hot after a period of time, because of bearing friction, and this heat flows to the mandrel and eventually to the workpiece; the diameter increases with temperature, so machining a warm



The fins radiate enough heat to keep the work cool

piece to size means an undersize diameter when cool.

To stop this heat transfer, an air-cooled mandrel has been developed whose fins dissipate the heat, presenting a cool contact point for the workpiece. The large end of the mandrel is gripped in the collet or chuck, and the small end has a slight taper to hold the workpiece by friction.

The finned mandrel is chucked and tested for concentricity, then the workpiece is placed on the small end. After a cut has been made, and dimensions checked, the carriage and slide stops are set.

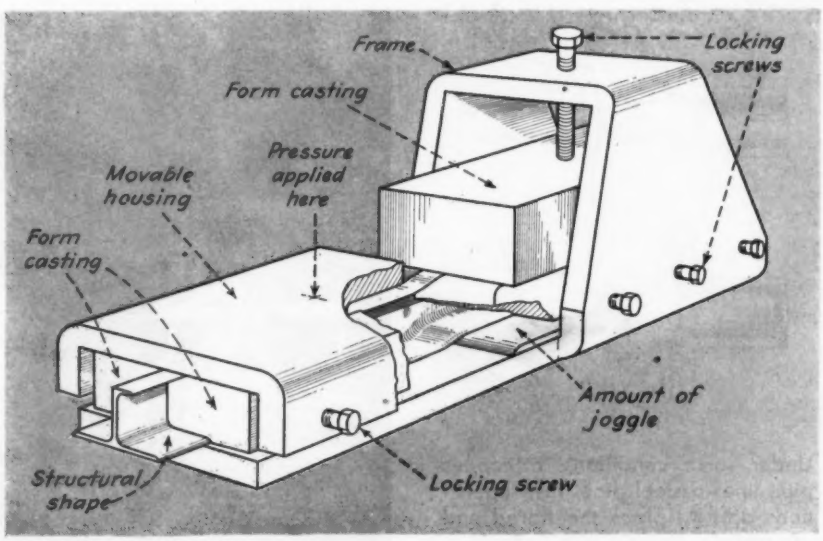
Because of the nature of the operations on the workpiece, the machine is running all the time, so there is no opportunity for the spindle to cool off. If the carriage and tool-slide stops are set cold, and the workpiece is warm, the diameter will be several ten-thousandths of an inch undersize when the workpiece cools. *War Winning Suggestion from the Board of Individual Awards, War Production Drive.*

Aluminum Structural Shapes Joggled With Inexpensive Tools

BY ELLIS COX AND FRANK RICHMOND
Northrop Aircraft, Inc.

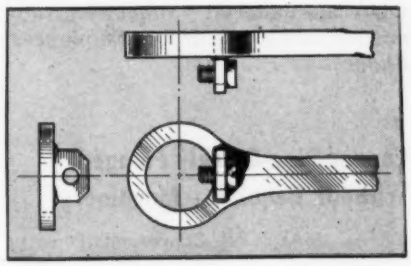
Joggling is the art of making short offsets in plates or structural shapes so that the overlapping joint presents an in-line surface without projecting edges.

For shapes made from aluminum, dural castings were made which surround the contour of the piece to be bent and hold it firmly in position. The amount of joggle or offset is determined by a bar inserted under the castings fixed in the frame. The movable housing carries the form castings fastened in it. Operation is simply to place the assembly on the platen or bed of a press or brake, insert the shape, then bring down the ram or slide on the movable housing.



Dural castings fit the shape rather closely and hold it while bending takes place. The frame and housing are made of steel. The filler under the frame castings determines the amount of offset

It is true that this is a temporary rig, but production can be maintained without too much expense. Estimated savings of 70 man-hours may be expected for each set-up. *War Winning Suggestion from the Board of Individual Awards, War Production Drive.*



A lug, welded to the side, provides a seat for a fillister-head screw which enters the hose connection hole in the cylinder and locks the wrench to it, preventing slippage during operation

Special Wrench Simplifies Removal of Landing-Gear Nut

BY CLAUDE H. ISRAEL
U. S. Naval Air Station, Jacksonville, Fla.

Removing the landing gear retracting cylinder nuts from some types of planes has been a clumsy and difficult operation, often resulting in damage to the cylinders and other mechanical parts. The operation is simplified and damage reduced to a minimum by the use of a special wrench, which is inexpensive and quickly made.

The circular end of this wrench slips over the cylinder head. A

fillister-head screw is put through a lug on the side of the wrench and engages the nut by screwing into the hose-connection hole in the cylinder. This forms a positive connection which makes removal and assembly easy.

The use of this wrench has made the operation safe and economical, showing a noteworthy reduction in labor and material. *Suggestion submitted under the Navy Employees' Suggestion Program.*

Copper Pipe Quickly Flanged Without Requiring Machinery

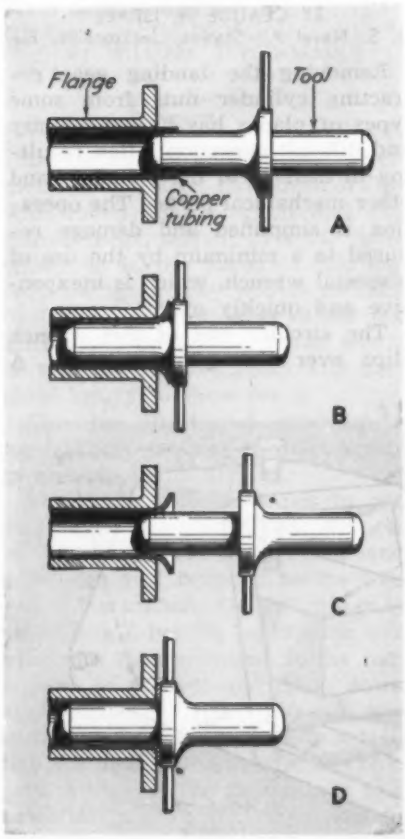
BY F. C. MAURONI, Coppersmith Foreman, Marinship Corporation, Sausalito, Calif.

Flanging is usually accomplished by heating the end of the copper pipe to a cherry red, then hammering repeatedly until the flange is formed. Hammer marks on the flanged surface are removed by turning in a lathe or sanding. This process is slow and costly.

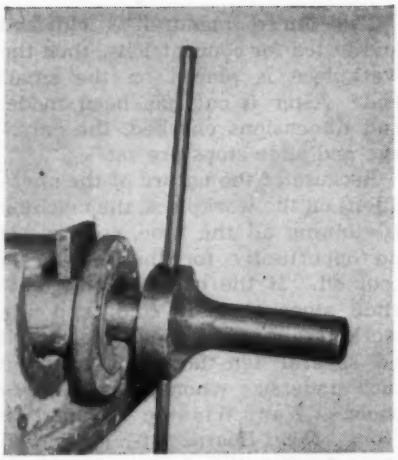
A more satisfactory method is to make a swaging tool from a steel bar, one side to flare the end of the tube, and the other to flatten the flare and square the flange.

The process is to use a back-up and slip on a flange, tighten in a vise, heat the end of the tube to a cherry red, then push in the flaring tool and strike it a few blows with a sledge. After the pipe has been flared, reheating may be necessary. The squaring end of the tool is then placed in the pipe; a few blows with the sledge complete the process. This tool does not leave hammer marks on the flange, so the joint is ready for use.

The accumulated labor saving is appreciable, aside from the better quality of joint obtained without any machining. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*



Under some conditions, a copper pipe lines a steel pipe, then operations are: *A*—place the flared end of tool in copper pipe; *B*—flare tubing; *C*—reverse tool so flanged end contacts flared tube; *D*—flatten flared end to form a flange



With a double-ended flaring and flanging tool, a man can flange copper pipe accurately in 20 minutes without denting or nicking the contact surfaces

Portable Pipe Flange Refacer Saves Dismantling Equipment

BY WALTER MORSE,
Foreman of Machine Pipers,
Bath Iron Works Corporation

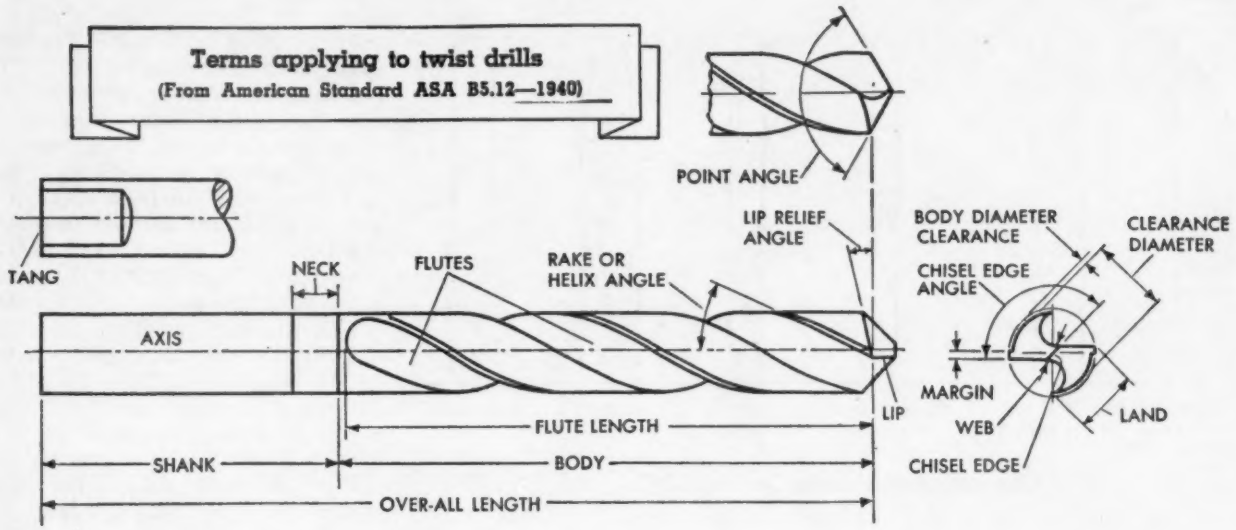
From a series of suggestions and sketches, a portable, air-driven, pipe-flange refacer progressed until a useful machine was developed.

Customary practice is to unship already installed equipment, transport it to the shop, set it up and machine, transfer it back again, then reinstall it—all of which requires much time and labor, besides disrupting other trades for days at a time and tieing up machinery.

This machine is arranged to bolt to flanges of piping already in place. It has a frame on the bottom of which a toolholder is mounted on a slide rotating about the vertical driven shaft. The vertical driven shaft carries a large gear meshing with a pinion on the vertical drive shaft. Power is supplied by a compressed-air motor attached to the vertical drive shaft.

Capacity of the machine is from 4 to 9 in. flanges and two cuts have been taken across a 4-in. flange in 15 min. Its usefulness is demonstrated by the time saved avoiding dismantling of installations. found aboard ship or ashore.

Simplicity of this portable refacing machine suggests numerous uses about shipyards, railroad shops, power houses and other places



Selection and application of

TWIST DRILLS

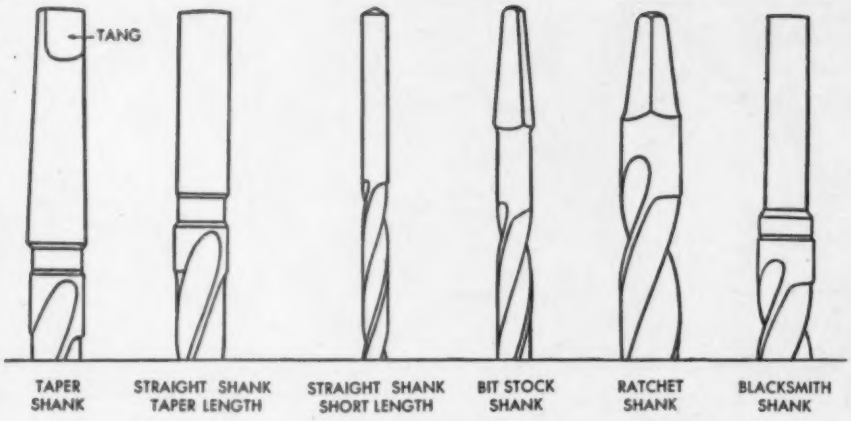
"TWIST DRILLS," as defined in the American Standard for Twist Drills —Straight Shank (ASA B5.12-1940), "are end cutting tools having one or more cutting edges, and having helical or straight flutes or grooves adjacent thereto for the passage of cuttings or chips. Twist drills are used for originating or enlarging (round) holes." This definition applies to the majority of the standard and special drills now used by the metal-working industry, even including the single-flute gun drills employed in rifle drilling machines.

Direct forerunner of the modern twist drill was the old style flat drill, which was forged in the blacksmith shop from length of square or rectangular carbon steel stock. These drills were flattened on one end to a rough diamond shape, then filed, or ground on a grindstone, to final shape. Though inefficient, these drills could be made quickly, and could be made with long shanks for deep holes.

History does not record the maker of the first milled-flute twist drill, but credit for being the first to engage in its manufacture is usually given to Stephen A. Morse, for in 1861 he started a small shop in East Bridgewater, Mass., to produce drills for the market. By 1864 or earlier he had devised a milling machine to cut the "increase twist" type of drill and a cutter to make the shape of flute necessary to produce the "straight lip," both of which features are covered in a patent granted to him on April 7, 1863. The most noteworthy change in the structure of the drill since that time is the use of the "constant angle" helix, introduced about 1892 to overcome the objectionable feature of the constantly changing rake angle at the cutting edge as the drill is shortened by regrinding. Drills are currently produced in many styles.

This special section was made possible through information obtained from the following sources:

Ace Drill Corporation
American Twist Drill Company
Ampco Twist Drill Company
W. F. & John Barnes Company
Black Diamond Saw & Machine Company
Black Drill Company
Edward Blake Company
Carboloy Company
Cleveland Twist Drill Company
Cogsdill Twist Drill Company
Covel Manufacturing Company
Firth-Sterling Steel Company
Fosdick Machine Tool Company
Gairing Tool Company
Grobet File Company of America
Lake Shore Tool Works, Inc.
Midwest Tool & Manufacturing Company
Morse Twist Drill & Machine Company
National Twist Drill & Tool Company
Oliver Instrument Company
Pratt & Whitney, Division Niles-Bement-Pond Company
Pratt & Whitney Aircraft, Division United Aircraft Corporation
Putnam Tool Company
Republic Drill & Tool Company
William Sellers & Company
Westinghouse Electric & Mfg. Company
Whitman & Barnes, Division United Drill & Tool Corporation
Wright Aeronautical Corporation



Conventional shanks for twist drills

DRILL NOMENCLATURE

AN IMPORTANT part of the American Standard for Twist Drills is a section on terminology and definitions, upon which the following description of standard twist drills is based.

A twist drill consists of a *point*, a *body*, a *neck*, and a *shank*. In some sizes, the neck is omitted. The *point* is the cone-shaped cutting end, made up of the ends of the *lands* and the *web*. The *body* is the portion of the drill between the point and the shank in which the helical grooves or *flutes* are cut or formed.

The *shank* is the end of the drill by which it is held and driven. There are a number of standard shanks, some of which are shown. *Straight shank* drills have cylindrical shanks, with or without driving flats, tang or grooves. *Taper shank* drills have conical shanks, usually a Morse taper, for direct fitting into tapered holes in the machine spindle. They usually have a *tang* on the end. *Taper square shank* drills have tapered shanks with four flat sides for fitting ratchets or braces.

The *over-all length* of a drill is the distance from the end of the shank to the outer corners of the cutting lips, while the *flute length*, or *length of twist*, is the distance from the outer corners of the lips to the extreme back end of the flutes. Length of the conical point is not included in either of these measurements.

The *land* is the periphery of that portion of the drill body not cut away by the flutes. There are two lands on a two-flute drill. The *margin* is that portion of the land, forming the full diameter of the drill, which is not cut away to provide *body diameter clearance*, or *land clearance*, and so reduce friction of the drill against the walls of the hole. This clearance also provides space for the cutting fluid to reach the point of the drill.

Clearance diameter is the diameter of the relieved portion of the drill body. Drills are usually made with *back taper*, or *longitudinal relief*. This helps prevent the drill from binding in the work. Most makers provide back taper within the limits prescribed by U. S. Army Specification No. 17-114A on twist drills, which are: for drills ⅜ in. diameter and less, 0.0003-0.0005 in. per in. of flute length; for drills 25/64 to 1 in. diameter, 0.0004-0.0006 in. per in. Above 1-in. diameter, the back taper in some cases is as much as 0.00075 to 0.001 in. per in. of flute length.

The central portion of the body that joins the lands is the *web*. The extreme end of the web forms the *chisel edge*. Minimum thickness of the web at the point, unless another specific location is indicated, is the *web thickness*. In most drills, the web is gradually tapered from the point to the shank, for added strength. Heavy-duty drills often are made with straight, thick webs.

The cutting edges of the drill, extending from the chisel edge to the periphery, are called the *lips*. The *helix angle* is the angle of the leading edge of the land with the *axis* (longitudinal center line) of the drill. The *point angle* is the angle included between the lips, and the *chisel edge angle*, or *center angle*, is the angle included between the chisel edge and the cutting edge, or lip, as seen from the end of the drill. The *lip relief angle*, or *clearance angle*, is the angle measured between a tangent on the surface back of the cutting edge at the periphery and a line at right angles to the axis of the drill.

Two-flute drills are conventional for originating holes. *Single-flute drills* with helical flutes are used principally for drilling wood and other soft substances. A single-flute drill with a straight, flat flute, sometimes called a *D-bit* or *half-round drill*, often is used on screw machines when accurate holes must be drilled. *Three-* and *four-flute* drills, usually called *core drills*, are used for enlarging drilled, cored or punched holes.

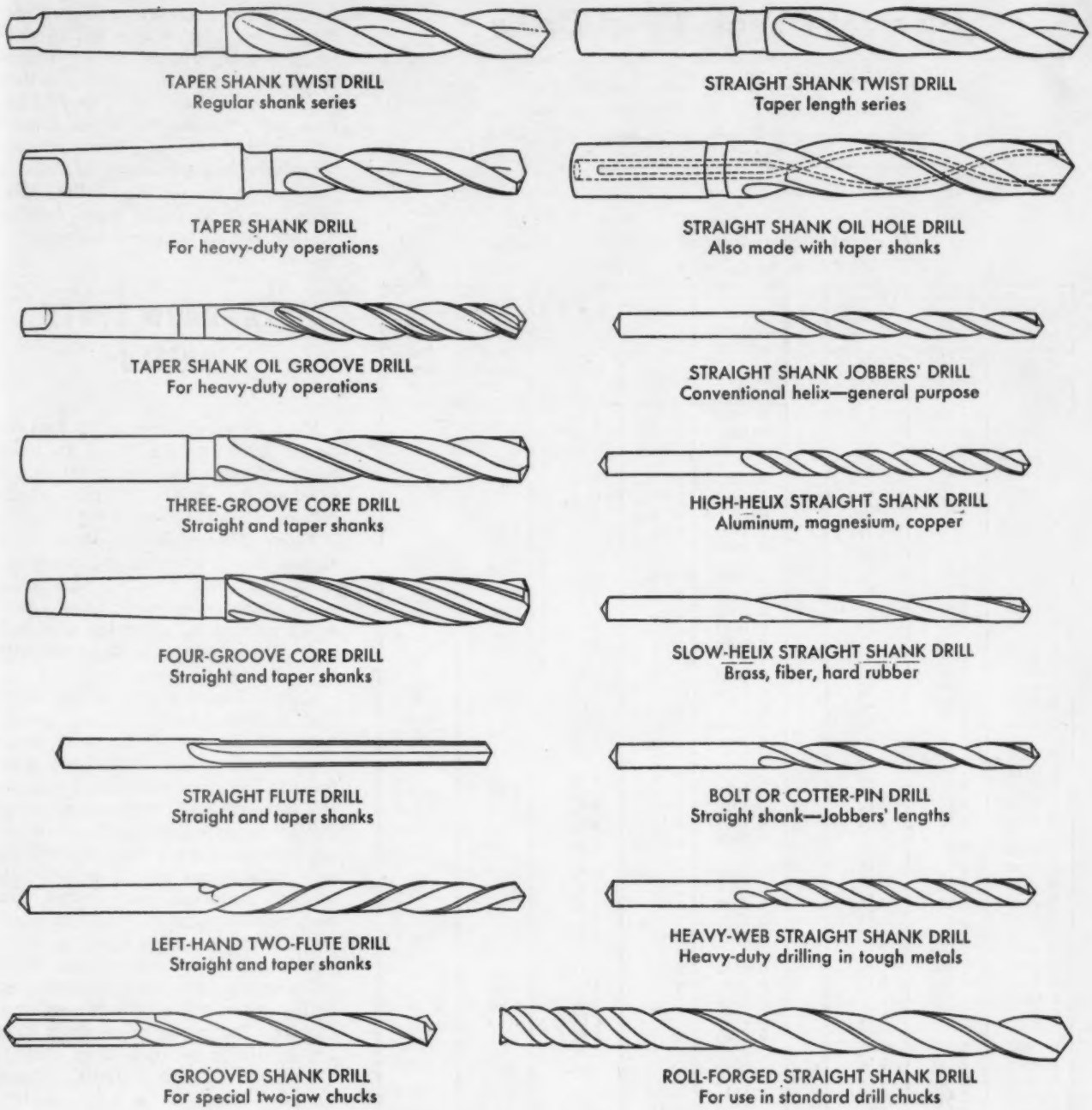
Most drills are made *right-hand*, that is, when looking toward the point of these drills, from the shank core, they must be rotated in a clockwise direction in order to cut. *Left-hand drills*, made to cut in a counterclockwise direction, are made for special applications.

DRILL STANDARDS

The twist drill has for many years been normally the product of companies equipped to make it economically. The result has been a standardization of design so that conventional drills from different makers are practically identical in appearance. Shank design has, of necessity, been standardized in order to permit interchangeable use of drills secured from different manufacturers. Drill diameters available as standard now are classified in a decimal inch series, and standard over-all and flute lengths have been arranged for each diameter.

The American Standard for Twist Drills covers a preferred list of 116 decimal size drill diameters ranging from 1/64 in. (0.0156 in.) to ½ in. (0.5000 in.), inclusive, selected to permit a reduction in the number of drill diameters ordinarily carried in stock as standard drills, and at the same time adequately to meet manufacturing requirements.

This standard replaces five commercial standards for twist drills of



Conventional types of twist drills for shop use

½ in. diameter and under. These consisted of the fractional series, the wire gage series (No. 80 to No. 1), the letter series, the millimeter series, and the decimal inch series upon which the present standard is based. The five series formerly used overlapped each other and resulted in an unnecessary multiplicity of sizes and designations. In many instances drills within a diameter range of a few ten-thousandths of an inch could carry designations in several series. While the present standard is confined to decimal inch sizes, it carries an appendix which gives in parallel columns the corresponding sizes in the old series. This information was included because many twist drills still in use or in stock carry obsolete size designations.

Most twist drills are made of either carbon steel or high-speed steel, others have inserts of cemented carbide to form the cutting edges. Still other drills are made from cast non-ferrous alloys, or from solid cemented carbide rods. The majority of drills made today are of high-speed steel, with or without a carbon steel shank joined to the drill body by electric butt welding or high-temperature brazing.

Most twist drills are made by milling the flutes from round bars, milling or grinding the lands for body clearance, and then heat-treating, and finishing by grinding. A number of manufacturers, however, have developed a forging process for high-speed steel drills ⅝ in. diameter and larger, in which straight flutes are formed to the proper contour in opposite sides of the bar by hammering between forging dies. The drill body then is twisted, while hot, to shape the flutes to the proper helix angle. These drills then are milled, heat-treated and ground, as for the milled-flute drills.

Straight Shank Twist Drills

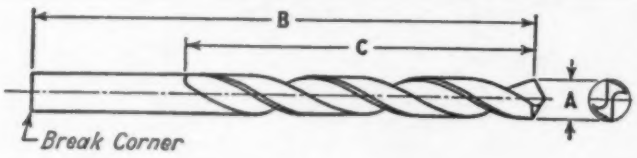


Table 1 General Dimensions of Drills With Diameters From 0.0156 to 0.2460 In., Inclusive

Diameter of Drill A	Over-All Length B	Flute Length C
0.0156	7/8	3/16
0.0180	15/16	3/16
0.0200	1	1/4
0.0225	1 1/8	1/4
0.0240	1 3/16	5/16
0.0260	1 5/16	7/16
0.0280	1 5/16	7/16
0.0295	1 3/8	7/16
0.0312	1 1/2	9/16
0.0330	1 1/2	5/8
0.0350	1 1/2	5/8
0.0370	1 1/2	5/8
0.0390	1 1/2	5/8
0.0410	1 9/16	11/16
0.0430	1 11/16	3/4
0.0453	1 11/16	3/4
0.0469	1 3/4	3/4
0.0492	1 11/16	3/4
0.0512	1 3/4	3/4
0 0531	1 3/4	7/8
0.0550	1 13/16	7/8
0.0571	1 13/16	7/8
0 0591	1 13/16	7/8
0.0610	1 13/16	7/8
0 0625	2 1/2	1 1/4
0.0630	1 7/8	7/8
0.0650	1 7/8	15/16
0.0670	1 15/16	15/16
0.0700	1 15/16	15/16
0.0730	2	15/16
0.0760	2 1/16	1 1/16
0.0781	2 5/8	1 3/8
0.0810	2 1/8	1 1/8
0.0827	2 3/16	1 3/16
0.0860	2 3/16	1 1/8
0.0890	2 1/4	1 1/8
0.0906	2 1/4	1 1/4
0.0937	2 3/4	1 1/2
0.0960	2 5/16	1 1/4
0.0995	2 7/16	1 3/8
0.1024	2 7/16	1 7/16
0.1040	2 1/2	1 3/8
0.1065	2 9/16	1 1/2
0.1094	2 7/8	1 5/8
0.1130	2 11/16	1 5/8
0.1160	2 11/16	1 5/8
0.1200	2 3/4	1 5/8
0.1220	2 3/4	1 5/8

Diameter of Drill	Regular Series		Long Series	
	Over-All Length	Flute Length	Over-All Length	Flute Length
A	B	C	B	C
0.1250	3	1 3/4	5 1/8	3
0.1285	2 13/16	1 3/4	....	....
0.1299	2 13/16	1 11/16	....	....
0.1339	2 13/16	1 11/16	....	....
0.1360	2 13/16	1 3/4	....	....
0.1378	2 13/16	1 11/16	....	....
0.1406	3 1/8	1 7/8	5 3/8	3 1/4
0.1440	2 15/16	1 7/8	....	....
0.1470	2 15/16	1 7/8	....	....
0.1520	3 1/16	1 7/8	....	....
0.1562	3 1/4	2	5 3/8	3 1/4
0.1610	3 3/16	2	....	....
0.1660	3 1/4	2	....	....
0.1695	3 5/16	2 1/8	....	....
0.1719	3 3/8	2 1/8	5 3/4	3 1/2
0.1730	3 5/16	2 1/8	....	....
0.1770	3 3/8	2 1/8	....	....
0.1800	3 7/16	2 1/4	....	....
0.1850	3 1/2	2 1/4	....	....
0.1875	3 1/2	2 1/4	5 3/4	3 1/2
0.1910	3 9/16	2 1/4	....	....
0.1935	3 5/8	2 3/8	....	....
0.1960	3 11/16	2 3/8	....	....
0.1990	3 11/16	2 3/8	....	....
0.2031	3 5/8	2 3/8	6	3 5/8
0.2090	3 7/8	2 1/2	....	....
0.2130	3 15/16	2 5/8	....	....
0.2187	3 3/4	2 1/2	6	3 5/8
0.2244	3 7/8	2 11/16	....	....
0.2280	4	2 3/4	....	....
0.2344	3 7/8	2 5/8	6 1/8	3 3/4
0.2402	3 7/8	2 11/16	....	....
0.2460	4	2 3/4	....	....
....	....	....	....	....
....	....	....	....	....
....	....	....	....	....
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Another method for producing high-speed steel twist drills has been announced recently. The so-called "Shankless" roll-forged drill, made in diameters from ¼ to 2 in., is produced by roll-forming hot bars with two diametrically opposed longitudinal straight flutes, then hot twisting the bars to the proper helix angle and roll straightening. After cutting to drill lengths, these drills are milled or ground to size, and processed as above. "All-Flute" drills for use in conventional drill chucks are made in the same manner, except that after the drill lengths have been cut off, the shank end of each is given an extra twist so as to close the flute spaces.

Ground-from-the-solid two-flute twist drills also are a recent development. For these drills, mill lengths of high-speed steel are heat-treated in a continuous furnace, then centerless ground. Drill lengths are then cut off, and the flutes ground with formed wheels. The manufacturer employing this process also is making, in limited quantities, solid two-flute twist drills from rods of Stellite and of tungsten carbide.

STANDARD STOCK DRILLS

Most twist drills are of conventional two-flute design, with helix angles, flute shapes, and point shapes selected for general-purpose application. Commonly used types are:

Taper Shank Drills—Made with Morse taper shanks in fractional diameters from ⅛ to 3½ in., inclusive. One producer lists taper shank drills up to 5 in. diameter as standard. Size of taper shank varies with drill diameter.

Cobalt Taper Shank Drills—Several drill makers offer heavy-duty taper shank two-flute twist drills made from cobalt high-speed steel for drilling jobs outside the range of conventional high-speed steel drills. Intended primarily for drilling high manganese steel, these drills give satisfactory results in difficult-to-drill materials like chilled cast iron, cobalt magnet steels and hardened laminated safe steels. To withstand severe drilling strains, these drills are shorter than conventional drills, and have oversize Morse taper shanks. Diameters range from ¼ to 1½ in., inclusive, in 1/32 in. steps.

Straight Shank Drills, Taper Length—These drills have straight shanks of the same diameter as the body, and have the same over-all lengths and flute lengths as taper shank drills. Made in fractional sizes from ⅛ in. to 2 in., inclusive. Flute lengths are approximately 60 percent of the over-all length.

Straight Shank Drills, Jobbers' Lengths—Having straight shanks of the same diameter as the drill bodies, these drills are of the so-called *short series* and are regularly made in four diameter series: (1) fractional series—1/64 to ½ in. diameter in 1/64 in. steps; (2) wire gage series—sizes from No. 80 to No. 1; (3) letter series—sizes from *A* to *Z*; and (4) metric series—diameters from 0.35 to 13.00 mm. Designed for general-purpose drilling in most materials.

Straight Shank Drills, Automotive Series—Of the same basic design as the Jobbers' length drills, but having greater over-all length and longer flutes, these drills are made in two lengths series: (1) "Short Length" drills are made in 47 diameter sizes from ¼ in. to 11/16 in.; and (2) "Long Length" drills are made in 29 diameter sizes within the same limits.

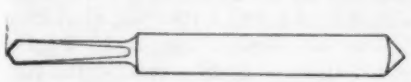
SPECIAL PURPOSE DRILLS

Small Flat Drills—Made in diameters from 0.002 to 0.100 in., inclusive, for right-hand or left-hand drilling in a wide range of materials. Standard drills have a blade length of about five times the drill diameter; they can be made with blades up to 15 times the blade diameter. In soft metal, like brass, speeds as high as 20,000 r.p.m. can be used, but in very hard steels the maximum speed is about 2,000 r.p.m. For very small drills (0.002 to 0.010 in. diameter), the speed should be lower.

Heavy-Duty Drills—Most drill makers offer heavy web two-flute twist drills, with larger helix angles than conventional drills, for drilling tough materials. They are stocked in straight shank Jobbers' length sizes. In extra long lengths, this type of drill is suitable for deep-hole drilling operations.

Fast-Helix Drills—Also stocked in Jobbers' sizes, these two-flute twist drills have higher helix angles (35-40 deg.) than conventional drills, and are designed for free cutting with easy chip removal. Usually recommended for deep holes in aluminum, magnesium, copper and die-cast metals. Web is slightly heavier than for conventional drills.

Slow-Helix Drills—Stocked in Jobbers' sizes, these two-flute twist drills with helix angles lower than for conventional drills are made in two types. Drills for Bakelite and other laminated plastics have low helix angles, thin webs, and wide, well-polished flutes. Often the heel of each land is cut away in opening up the flutes. This drill can be used for shallow holes in aluminum and magnesium. The well-known *Brass* drill has a heavier cross-section than the *Bakelite* drill, but is lighter than the conventional drill. Helix angle is moderately low. Used for brass, hard rubber and fiber.



Flat drill for small holes

Cotter Pin Drills—Usually made in diameters from No. 60 to ¼ in., in Jobbers' lengths, these drills have heavier webs and slightly higher helix angles than conventional drills. Designed for drilling cross holes in shafts and axles. Have straight shanks.

Body Drills—Straight-shank, two-flute twist drills with short flute lengths, designed for use in portable power drills for thin materials.

Extension Drills—Small-diameter, two-flute twist drills with long spring-tempered straight shanks. Used for drilling rivet holes in inaccessible corners in aircraft assembly operations.

Center Drills—Stubby straight-shank, two-flute twist drills used when center holes in shaft ends are drilled and reamed in separate operations. Made in fractional sizes 1/16 to 5/16 in. diameter.

Combination Center Drills—These combined drills and 60-deg. countersinks, made either single- or double-end, permit center drilling and

Straight Shank Twist Drills

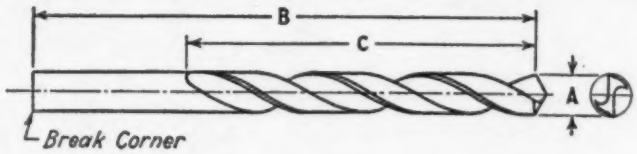


Table 2 General Dimensions of Drills With Diameters From 0.2500 to 0.5000 In., Inclusive

Diameter of Drill	New Lengths				Conventional Lengths			
	Regular Series		Long Series		Jobber's or Short Series		Taper or Long Series	
A	Over-All Length B	Flute Length C	Over-All Length B	Flute Length C	Over-All Length B	Flute Length C	Over-All Length B	Flute Length C
0 2500	4 1/2	3 1/8	6 1/2	4 5/16	4	2 3/4	6 1/8	4
0.2520	4 1/2	3 1/8	....	....	4	2 5/8	....	....
0.2570	4 1/2	3 1/8	....	....	4 1/8	2 7/8	....	....
0.2610	4 1/2	3 1/8	....	....	4 1/8	2 7/8	....	....
0.2656	4 1/2	3 1/8	6 1/2	4 5/16	4 1/8	2 7/8	6 1/4	4
0.2720	4 1/2	3 1/8	....	....	4 1/8	2 7/8	....	....
0.2770	4 1/2	3 1/8	....	....	4 1/8	2 7/8	....	....
0.2812	4 3/4	3 3/8	6 3/4	4 1/2	4 1/4	2 31/32	6 1/4	4
0.2854	4 3/4	3 3/8	....	....	4 1/4	3	....	....
0.2913	4 3/4	3 3/8	....	....	4 1/4	3	....	....
0.2969	4 3/4	3 3/8	6 3/4	4 1/2	4 3/8	3 3/32	6 3/8	4 1/16
0.3020	4 3/4	3 3/8	....	....	4 3/8	3 1/8	....	....
0.3071	4 3/4	3 3/8	....	....	4 3/8	3 1/8	....	....
0.3125	5	3 5/8	7	4 11/16	4 1/2	3 3/16	6 3/8	4 1/16
0.3160	5	3 5/8	....	....	4 1/2	3 1/4	....	....
0.3230	5	3 5/8	....	....	4 5/8	3 5/16	....	....
0.3281	5	3 5/8	7	4 11/16	4 5/8	3 5/16	6 1/2	4 1/8
0.3320	5	3 5/8	....	....	4 3/4	3 7/16	....	....
0.3390	5	3 5/8	....	....	4 3/4	3 7/16	....	....
0.3437	5 1/4	3 7/8	7 1/4	4 15/16	4 3/4	3 13/32	6 1/2	4 1/8
0.3480	5 1/4	3 7/8	....	....	4 7/8	3 1/2	....	....
0.3543	5 1/4	3 7/8	....	....	4 7/8	3 17/32	....	....
0.3594	5 1/4	3 7/8	7 1/4	4 15/16	4 7/8	3 17/32	6 3/4	4 1/4
0.3680	5 1/4	3 7/8	....	....	5	3 5/8	....	....
0.3750	5 5/8	4 1/8	7 5/8	5 1/8	5	3 5/8	6 3/4	4 1/4
0 3860	5 5/8	4 1/8	....	....	5 1/8	3 3/4	....	....
0.3906	5 5/8	4 1/8	7 5/8	5 1/8	5 1/8	3 3/4	7	4 3/8
0.3970	5 5/8	4 1/8	....	....	5 1/8	3 3/4	....	....
0.4062	5 5/8	4 1/8	7 5/8	5 1/8	5 1/4	3 27/32	7	4 3/8
0.4219	5 5/8	4 1/8	7 5/8	5 1/8	5 3/8	3 31/32	7 1/4	4 5/8
0.4375	6 1/8	4 7/16	8 1/8	5 7/16	5 1/2	4 1/16	7 1/4	4 5/8
0.4531	6 1/8	4 7/16	8 1/8	5 7/16	5 5/8	4 3/16	7 1/2	4 7/8
0.4687	6 1/8	4 7/16	8 1/8	5 7/16	5 3/4	4 9/32	7 1/2	4 7/8
0.4844	6 1/8	4 7/16	8 1/8	5 7/16	5 7/8	4 13/32	7 3/4	5
0.5000	6 1/8	4 7/16	8 1/8	5 7/16	6	4 1/2	7 3/4	5

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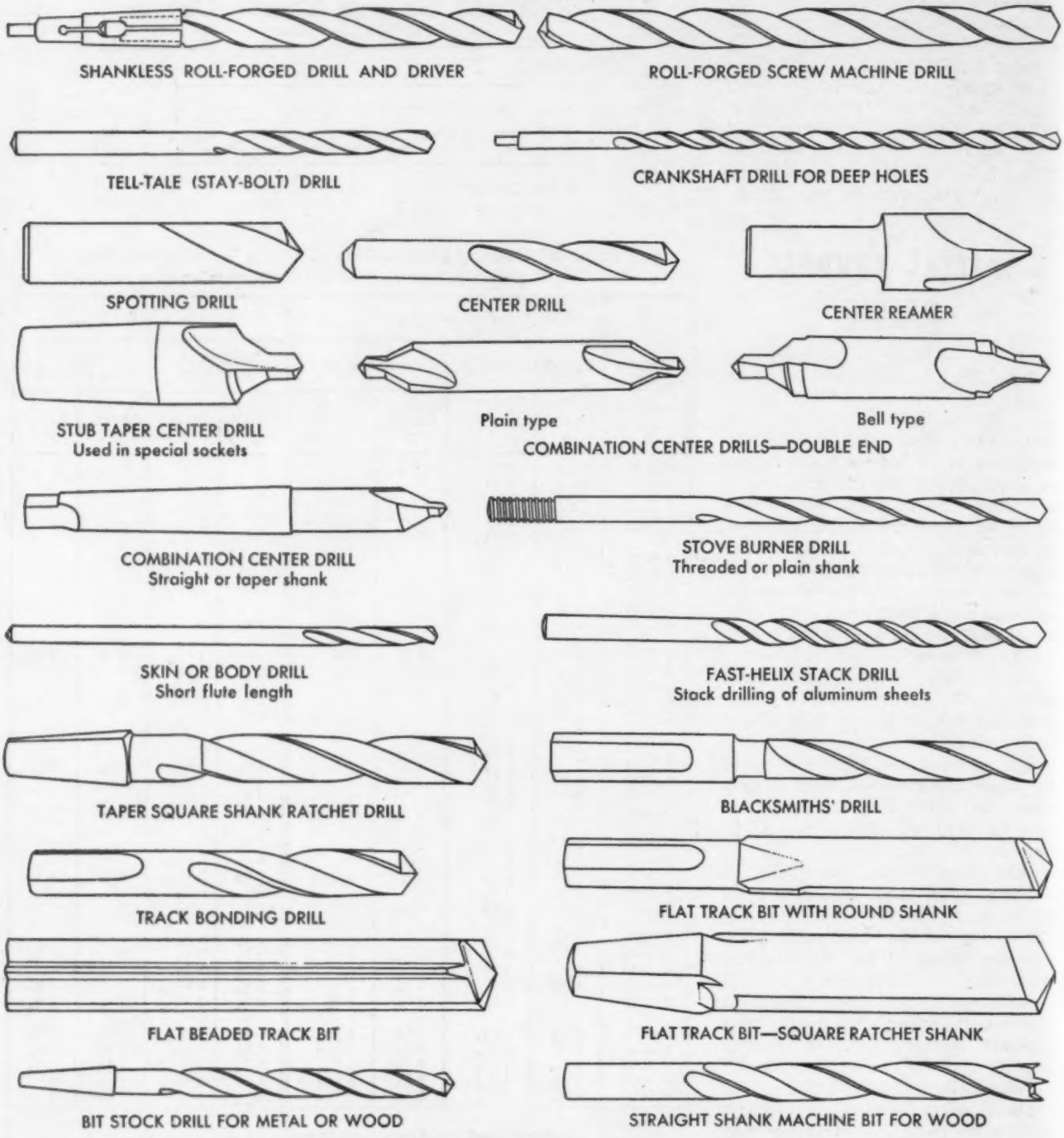


Conventional drills and special-purpose drills

reaming shaft ends in one operation. Made in 13 standard sizes.

Tell-Tale Drills—For drilling tell-tale holes in boiler stay-bolts, these straight-shank, two-flute twist drills are made in 3/16 and 7/32 in. diameters in "Short" and "Long" series lengths.

Blacksmiths' Drills—For use in blacksmiths' drill presses. *Coe's* drills have 0.648 in. (commonly termed ⅝ in.) diameter and 2¼ in. long flatted round shanks. Made in diameters from ½ to 1¼ in., all 6 in. long over all. *Silver & Deming* drills have ½ in. diameter and 2¼ in. long flatted round shanks; diameters range from ⅛ to 1 in. *Prentice* drills have ½ in. diameter and 2½ in. long flatted round shanks; diameters range from ⅜ to 1 in. All three types are made in both carbon steel and high-speed steel series.

Bonding Drills—Made for drilling railroad track sections for bonding wires. Stubby design, with thick web, for use in portable drilling machines. Made in 9/32 and ⅜ in. body diameters, with either 9/32 or ⅜ in. flattened round shanks. Each has 1¾ in. flute length.

Bit-Stock Drills—Made for use in ratchet braces and suitable for drilling metal or wood when properly pointed. Usually made of carbon steel, in diameters from 1/16 to 1¼ in. Have 3/16 in. by ⅜ in. by 1¼ in. long taper square shanks. Sometimes made with long shanks.

Ratchet Drills—Two-flute high-speed steel or carbon steel drills for use in heavy-duty ratchet type drills.

Usually made in diameters from ⅛ to 1¼ in. No. 1 shank is ⅜ in. by ⅝ in. by 1½ in. long; No. 2 shank measures ½ in. by ¾ in. by 1¾ in.

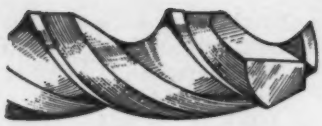
Flat Track Bits—Used in hand and power operated portable track drilling machines. Furnished in several styles; all have over-all length of 6¼ in. Made in diameters (width of blade) from ½ to 1½ in. Thickness is ¼ in. for narrower bits; ⅜ in. for wider bits. Points have included angle of 135 deg.

Straight-Flute Drills—The conventional two-flute drill with straight (0-deg. helix angle) flutes has considerable application in drilling brass and some other copper alloys. Usually made in diameters ¼ in. and above, right- or left-hand, to same dimensions as conventional drills of same size.

Grooved-Shank Drills—Have same dimensions as straight-shank drills of same size and type, except that shank has two diametrically opposed grooves milled longitudinally along shank for two-jaw chucks.

OIL-HOLE DRILLS

Developed for use where lubrication and cooling of the drill point is difficult, as when using the drill in a horizontal or inverted position, and where oil or air pressure is needed to help eject the chips, oil-hole drills have small holes through each of the two lands for delivery of cutting fluid or compressed air directly to the lips of the drill. They are made in either straight or taper shank types. Drills of this type usually are held stationary, and the work rotated, but by using slip couplings, the drill can be rotated while feeding fluid or air through the land holes. Oil-hole drills should not be confused with *oil-groove drills*, which have grooves milled along each land to promote movement of cutting fluid to the drill point. The oil-hole type seldom is made in diameters less than ⅝ in. For smaller holes, the single-flute gun drill, made by fitting a high-speed steel or carbide cutting head to a length of properly shaped tubing, is efficient. In such drills, the cutter end is drilled longitudinally so oil from the tube can be delivered just back of the cutting edge.



Crankshaft-type drill point

DEEP-HOLE DRILLS

The drilling of deep holes (five or more times the drill diameter in depth) is difficult in most metals. Trouble is experienced in holding hole size and alignment, and wall finishes are often poor. If proper drills are not used, chips pack in the flutes and cause rapid drill wear or breakage. Where hole diameter is large (above ⅝ to ¾ in.) oil-hole drills often can be used to advantage. Single-flute gun drills, or two-flute gun bits mounted on tube extension shanks generally are used for extremely long holes, as in drilling gun barrels.

For holes smaller than ½ to ⅝ in., drills with conventional flute design and heavy, straight webs, but with high helix angles, are suitable for some materials. Experiments in drilling magnesium, for example, show that while drills with helix angles of 10-20 deg. are best for shallow holes the helix angle should be increased to 40-45 deg. for holes more than four to five times their diameter.

Where it is necessary to drill deep, small-diameter holes in the harder and tougher steels, as when drilling crankshafts and connecting rods, special drills having heavier webs and slightly faster helix angles are best. In these drills, the web often is as heavy as 40 percent of the drill diameter. These drills are ground with a special point to break up the chips and reduce end thrust on the drill. First, the drill is given a 118-128 deg. point angle, with about 9-deg. lip relief and 100-deg. chisel edge angle. Then the heel of each land is ground away to provide a secondary relief angle of about 55 deg. A wheel having a sharp corner is used, and sufficient stock is ground away from each heel so that the two new lips so formed meet at the axis of the drill and are at right angles to the chisel edge at the drill point.

When drilling deep holes with helical-flute drills, speeds and feeds must be reduced as the depth of the hole is increased. Also, with small diameter drills it is often necessary to withdraw the drill from the hole occasionally to clear the chips. This can be done manually, or a special unit can be applied to feed, withdraw and return the drill in automatic cycles until the desired depth is reached.

CORE DRILLS

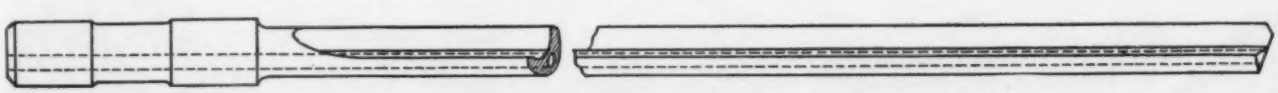
For enlarging cored, drilled or punched holes, three- or four-flute core drills are employed. These drills will not cut holes in solid material, as the cutting edges do not extend to the center of the drill. Cutting is done by a chamfered edge at the end of each flute. Solid three-flute core drills are available in diameters from ¼ to 3 in.; similar four-flute drills are not made in diameters smaller than ½ in. In the larger diameters, core drills usually are made with a fluted cutter interchangeably mounted on the end of a fluted body. Such tools often have pilots to insure accuracy of hole alignment.

MULTI-CUT DRILLS

With drills of proper construction, it is possible to drill two or more diameters in one operation, or to combine the drilling operation with a chamfering, counterboring, countersinking, or reaming operation. Such drills are used for mass production operations with savings in production time.

Step Drills—Having two or more diameters, produced by grinding successive steps on the lands of standard two-flute twist drills, or three- or four-flute core drills, step drills can be used for drilling in solid stock, or for pierced or cored holes. Usually the web must be thinned on two-flute drills of this type, and the lands must always be cleared on each step.

Combination Tools—Two-flute twist drills often can be combined with straight or helical fluted reamers or core drills on the same shank.



Single-flute gun drill

These combination tools have the advantage of being able to perform dual operations with the accuracy of paired sets of drills and reamers, in half the time. Life is limited to that of the drill portion. For accuracy, the drill should be long enough to complete its cut before the reamer or core drill reaches the work.

Multi-Land Drills — Sometimes known as *Sub-Land* or *Multi-Cut* drills, these tools perform the same function as step drills. While the step drill has all of its steps on the same land, the multi-land drill has two or more distinct lands for substantially the entire length of each flute. Thus, the various diameters are maintained constant throughout the life of the tool by merely sharpening the cutting edges at the end of each set of lands. More expensive than step drills, these tools cost less to resharpen. Drilling from the solid can be combined with chamfering, countersinking, counterboring, or reaming. The combination drill and reamer should be used only in through holes where the depth is not more than one and one-half times the drill diameter, and length of the drill section should be at least equal to the depth of the hole. It is best not to have too much variation in diameters of the different steps, due to the resultant differential in cutting speeds.

CARBIDE-TIPPED DRILLS

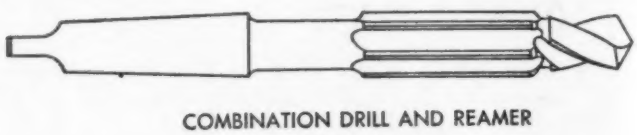
For drilling non-metallic materials, especially those of an abrasive nature, two-flute drills with helical or straight flutes are tipped with one of the cemented carbides by brazing a tip in a slot milled across the end of the drill in such a way that the cutting edges are in proper relation with the flutes. For drills from ⅛ to ¼ in. diameter, flat tips are used. Shaped tips are available for larger sizes to give each cutting surface approximately the same shape as the flute surface it joins. Carbide-tipped masonry drills are standard in sizes from ⅛ to 2 in. diameter for various purposes.

DRILLS FOR HARD MATERIALS

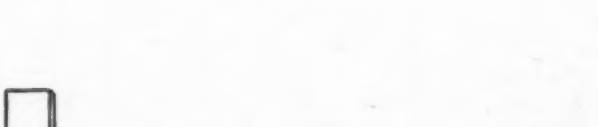
There is a practical limit of hardness beyond which some materials cannot be drilled with high-speed steel drills. Often holes in heat-treated alloy steels, hard castings, and chilled cast iron can be drilled if (1) the work is well supported and held rigidly, (2) a heavy-duty drill press is used, (3) the drill is short and stubby, with a relatively heavy web, and low lip relief, (4) the proper cutting fluid is used, (5) speed is low, try 20 to 30 ft. per min., and (6) feed is medium to heavy—it is important to keep the drill cutting continuously.

Hardened steels of any hardness can be drilled with triangular "Hard-steel" drills of a cast non-ferrous

TWO-STEP TAPER SHANK DRILL

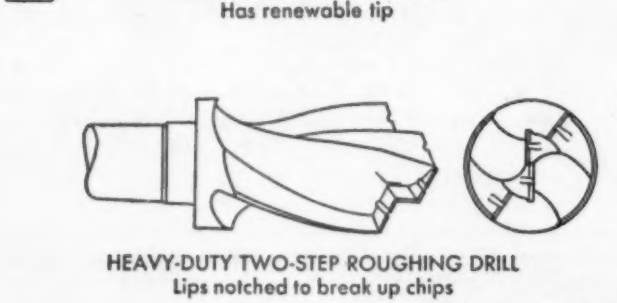


COMBINATION DRILL AND REAMER



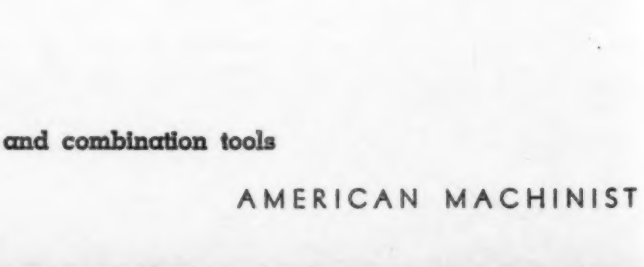
THREE-STEP CORE DRILL

TWO DIAMETER MULTI-LAND DRILL



HEAVY-DUTY OIL HOLE DRILL
Has renewable tip

MULTI-LAND DRILL AND REAMER



HOLES PRODUCED WITH MULTI-LAND DRILLS

HEAVY-DUTY TWO-STEP ROUGHING DRILL
Lips notched to break up chips

Special multi-cut drills and combination tools

alloy. The pyramid point has a chip clearance groove ground in each side. These drills cut by rubbing the material so that frictional heat anneals the metal in immediate contact with the drill point, and then scraping this annealed surface away. They will not cut unheat-treated or soft metals.

Rather sensational results in drill-holes in hardened steel toolbits of Rockwell C63-64 have been secured by making replicas of the above type of drill from carbide rod such as is used for making boring bits.

Solid ground-from-the-solid tungsten carbide two-flute twist drills also can be used for drilling hardened steel. Action is much like that of the "Hardsteel" drill, in that frictional heat raises the temperature of the metal to red heat, then the cutting lips raise chips in the normal manner. Hand feed is recommended, as time must be allowed for heating the work.

DRILL DRIVERS

A secure connection between the drill and its driving spindle is essential. Taper shank drills are fitted directly into the tapered socket in the end of the machine spindle, or into a sleeve or adaptor which, in turn, fits in the spindle. For heavy operations, taper shank drills often have the shank flatted on one side for assembly with a "Use-Em-Up" type sleeve or socket. This provides a positive drive for the full length of the shank. These drivers originally were developed for salvaging taper shank drills from which the tangs have been broken.

Straight shank drills usually are held either in the jaws of adjustable or collet-type drill chucks, or in straight sleeves into which they are locked with setscrews. For production jobs, collet-type split sleeves, or drill drivers, having a Morse taper on their outer surface, are finding increasing use for driving straight shank drills. The end of the drill has a tang to fit in a slot in the driver so as to insure a positive drive. When assembled, the drill and driver are driven firmly into the tapered hole in the machine spindle so that the driver grips firmly around the shank of the drill.

HOW TWIST DRILLS SHOULD BE USED

THE TWIST DRILL is one of the most efficient tools for cutting materials, for in no other tool is the cutting surface so large in proportion to the cross-sectional area of the body. In forming the flutes, practically 50 percent of the original metal is removed, yet a twist drill will bear more stress in proportion to its own strength than any other tool, for the reason that it is supported by the metal in which it is cutting. At the same time, the drill is one of the most abused cutting tools in general use in the shop. Ordinarily, a drill is selected for size (diameter and length) only, without regard to whether its design is correct for the job at hand. And all too frequently it is used incorrectly after it has been set up in the machine.

The degree of accuracy of the hole produced by a drill will depend upon a number of factors other than the diameter of the drill. They are:

1. Sharpening—Accuracy of the drill point influences the performance and grinding life of the drill, as well as the accuracy of the drilled hole. Cutting edges must be of the same length and must be at equal angles with the axis of the drill. Shape and angles of the relief back of the cutting edges must be the same on each side. The chisel edge must be in the center of the drill. Rake on the lips must be the same. Cutting lips must be 180 deg. apart. *Machine sharpening is best.*

2. A drill supported in a hardened drill bushing will produce a better hole than one permitted to find its own center. Bushings must guide the drill without binding. Be sure to provide space for clearing chips.

3. Amount of back taper on the drill is a factor because the drill diameter is reduced each time the drill is sharpened.

4. Nature of material to be drilled —The same diameter drill will cut holes of varying size in different materials. In some materials, like the refractory bronzes, it is desirable to grind the center slightly off center so that the hole drilled will be larger than the drill and so prevent binding of the drill in the hole when the material cools.

5. Rigidity of the machine, the fixture and the work are just as important to efficient drilling as is the selection of the proper drill.

Where the hole diameter must be held to close limits, it usually is best to use an undersize drill and finish by reaming, grinding or boring.

Experience has shown that drills of different designs sometimes are more efficient than conventional drills in some materials. Some shops use only conventional stock drills because of the difficulty of controlling the disbursement of special drills from tool cribs. The saving possible by using special drills will, in many cases, justify the added expense entailed by issuing such drills according to tool numbers, rather than by size alone.

Experimental work with drills of various helix angles, point angles, web thicknesses and flute shapes indicates the desirability of studying each drilling job to determine whether the best results are obtained with drills of conventional design, or whether special drills are justified. At times, a change in the shape of the drill point, the use of a drill with a different helix angle, the use of wider flutes or polished flutes, or the use of a multi-diameter drill, will amply repay the expense of analyzing the job and providing a special tool.

Drilling efficiency often can be improved by better design and construction of the jigs and fixtures employed in drilling operations. Overall operation time can be reduced by using quick-acting devices for locating and clamping the work. The work must be held securely against movement relative to the jig and the machine during the drilling operation. Also, the work must be supported in such a way that it does not bend due to the drilling pressure. Bending will result in holes that are oversize and out of line. Often, it causes excessive drill breakage.

Wherever possible, space should be provided between the work and the drill bushing so chips can be cleared from the drill flutes below the bushing. This helps eliminate clogging of chips in the flutes and aids by admitting more cutting fluid to the drill point. However, the bushing should not be so far away from the work that the drill can bend in the space between the bushing and the work. Also, too long a bushing will cut down the useful life of the drill, while a bushing that is too short will permit the drill to bend out of line. Further, it is important that the bushing fit the drill closely without binding. A minimum clearance of 0.0005 to 0.001 in. is desirable.

Suggested Drill Point Angles for Different Materials

MATERIAL TO BE DRILLED	POINT ANGLE	LIP RELIEF	CHISEL EDGE	HELIX ANGLE
Conventional-Drills (Average Conditions, Average Shop Materials)	118	12-15	125-135	20-32
Conventional Drills (Average Conditions, Hard Materials)	118	6-9	115-125	20-32
Aluminum Alloys (Shallow Holes)	90-120	12	125-135	17-20
Aluminum Alloys (Deep Holes)	118-130	12	125-135	32-45
Brass and Bronze, Soft	118	12-15#	125-135	10-30
Brass and Bronze, Free Machining	118-125	12-15#	125-135	0-20
Bronze, Hard (Aluminum and Manganese)	118	5-7	115-125	10-30
Copper and Some Copper Alloys	100-130	10-15	125-135	30-40
Cast Iron, Soft	90-118	12-15	125-135	20-32
Cast Iron, Chilled	118-135	5-7	115-125	20-32
Die Castings, Zinc, Etc.	60-136	12-20	125-135	32-45
Fiber	60-90	12-15	125-135	17-20
Magnesium Alloys (Shallow Holes)	70-118	12-15	120-135	10-20
Magnesium Alloys (Deep Holes)	118	12-15	135-150	40-45
Marble	90	12	125-135	20-32
Nickel Alloys, Monel, Nickel, Etc.	118	12-15	125-135	20-32
Nickel Alloys, Hard, Inconel	135-140	5-7	115-125	20-32
Plastics, Laminated (Bakelite, Etc.)	90-118	12-15	125-135	10-20
Plastics, Molded	60-90	12-15	125-135	10-20
Rubber, Hard	60-90	12-15	125-135	10-20
Slate	118	12-15	125-135	20-32
Steel, Soft, Low Carbon	118	12-15	125-135	20-32
teel, Forged, Annealed	118-125	12-15	125-135	20-32
Steel, Cast	118	12-15	125-135	20-32
Steel, Alloy Forged (Crankshafts)	118-140	9 & 55	100	25-35
Steel, Manganese (7-13% Manganese)	150	10#	115-125	20-32
Steel, High-Speed	135	5-7	115-125	20-32
Steel, Nickel (Up to 200 Brinell)	118	10	115-125	20-32
Steel, Nickel (About 250 Brinell)	130-140	5-7	115-125	20-32
Steel, Nickel (About 300 Brinell)	130	5-7	115-125	20-32
Steel, Nickel (About 350 Brinell)	130-150	5-7	115-125	20-32
Steel, Nickel (About 400 Brinell)	150	5-7	115-125	20-32
Steel, Nitriding (About 250 Brinell)	130-140	5-7	115-125	20-32
Steel, Nitriding (Free Machining)	118	10	125-135	20-32
Steel, Stainless	118-140	5-7	115-125	20-32
Wood	70	12	125-135	30-40

#—Lips flatted to reduce rake angle.

NOTE: In general, the helix angle for conventional drills varies with the diameter of the drill.

And it will pay to make sure that the drill selected is used properly. Sometimes a drill is run backward—in a drill press having a reversing motor drive for tapping, and run by an inexperienced worker. Speeds and feeds must be selected carefully, and checked from time to time to insure that desired operating conditions are maintained. The proper cutting fluid must be selected, and kept clean.

The varying conditions under which drills must perform make it impossible to fix rules for speeds and feeds. Those shown in the accompanying table should be considered as starting points in determining those best for a given job. When drilling material of unknown hardness, start with a slow speed and light feed, gradually increasing both to a point where the drill shows signs of failure. Then adjust accordingly.

If the outside edges of the lips wear rapidly, the speed is too high. Chipped cutting edges and split webs indicate too heavy a feed. Improper drill grinding leads to broken drills, rough holes, oversize holes, or bell-mouthed holes. Feeds should be sufficient to produce properly formed chips. Usually, the most efficient conditions result with heavy feeds and moderate speeds.

When chatter occurs, it may be due to torsional deflection of the drill, or lack of rigidity of the set-up. Often, the use of a shorter drill, or one with a heavier cross-section, will reduce or eliminate chatter. Rough, inaccurate holes often can be eliminated by grinding a chamfer or radius on the outer corner of each lip of the drill.

RESHARPENING

Best drilling results are obtained only when the drills are properly pointed. Dull drills lead to inaccurate holes, lowered drilling efficiency, and broken drills. When resharpening a drill, the main things to consider are:

1. The point angle of the cutting lips—while the angle of the lips with the axis of the drill may vary a few degrees either way from the angle selected, it is essential that each lip be at the same angle with the axis. Otherwise, most of the cutting will be done by one lip, wear on the lips will be uneven, and the hole will be oversize.

2. Length of the cutting lips must be the same; if they are not the chisel edge will be off center, even

Suggested Speeds for Different Materials

MATERIAL TO BE DRILLED	CUTTING SPEED FT. PER MIN.
Aluminum and its Alloys	200-300
Bakelite	100-150
Brass and Bronze, Soft	200-300
Bronze, High Tensile	70-100
Carbon, Pure (Carbide Drills)	100
Cast Iron, Soft	100-150
Cast Iron, Hard	70-100
Cast Iron, Chilled	30-40
Copper Graphite Alloy (Carbide Drills)	60-70
Glass (Carbide Drills)	20-30
Magnesium and its Alloys	250-400
Malleable Iron	80-90
Marble	15-25
Marble (Carbide Drills)	60-80
Nickel and Monel	40-60
Slate	15-25
Slate (Carbide Drills)	40
Steel, Machinery (0.2-0.3 c)	80-110
Steel, Annealed (0.4-0.5 c)	60-70
Steel, Tool (1.2 c)	50-60
Steel, Forged	50-60
Steel, Alloy	50-70
Steel, Stainless, Free Machining	60-70
Steel, Stainless, Hard	30-40
Steel, Manganese	15
Stone	15-25
Stone (Carbide Drills)	30
Wood	300-400

NOTE: Except as noted, speeds given above are for high-speed steel drills. Carbon steel drills should be run at from 40 to 50 percent of those for high-speed steel drills. These speeds are given as starting points, the best speed in each case must be based on the prevailing conditions, material, set-up, etc.

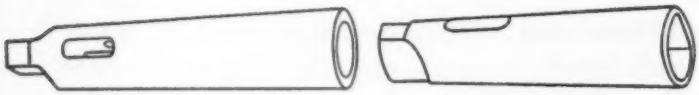
Suggested Feeds for Various Drills

DIAMETER OF DRILL, INCHES	FEED IN. PER REV.
Under 1/8	0.001 to 0.002
1/8 to 1/4	0.002 to 0.004
1/4 to 1/2	0.004 to 0.007
1/2 to 1	0.007 to 0.015
1 in. and over	0.015 to 0.025

NOTE: It is best to start with a moderate speed and feed, increasing either one, or both, after observing the action and condition of the drill.

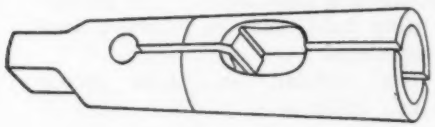
SOCKET FOR TAPER SHANK DRILL

"USE-EM-UP" FITTED SOCKET

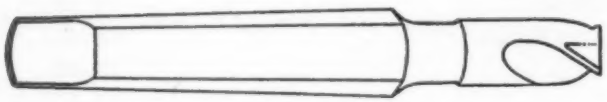


Plain sleeve "Use-Em-Up" sleeve

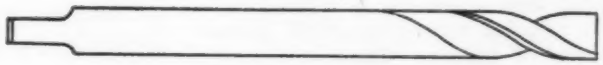
SLEEVES FOR TAPER SHANK DRILLS



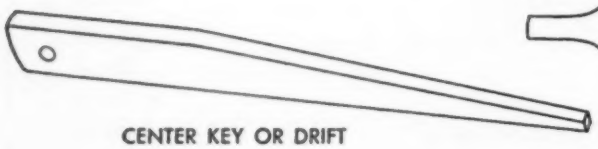
SLOTTED (COLLET) DRIVER
For straight shank drills



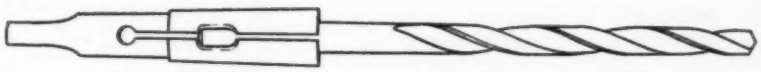
TAPER SHANK FLATTED
For "Use-Em-Up" sleeves or sockets



STRAIGHT SHANK DRILL WITH TANG
For slotted (collet) driver



CENTER KEY OR DRIFT



STRAIGHT SHANK DRILL FITTED WITH DRIVER

Drill drivers, sockets and sleeves

though the lips may be at the same angle with the axis. This condition will cause the drill to cut oversize, put an overload on the spindle bearings, and cause rapid drill wear. The worst condition is when the lips are of unequal length and the lips are ground at different angles with the drill axis.

3. Relief on the cutting lips must be the same, and must be adequate for the material and rate of feed. The relief angle must increase as the center of the drill is approached. The reason is that the distance through which a given point near the center travels is much smaller than the distance traveled by a point on the periphery, while the amount of advance per revolution is the same for the two points. For example, the angle of advance of a 1-in. drill with a feed of 0.015 in. per rev. is 0 deg. 17 min. at the periphery and 1 deg. 6 min. at a point ⅛ in. from the center of the drill. Lip relief must be increased from the periphery to the center in approximately the same proportion. It must be greater than the angle of advance due to the feed, but not too great or the cutting edges will be weakened unnecessarily.

4. Lip shape—it sometimes is necessary to alter the shape of the lips of a drill by grinding their faces. Chips can be broken up into smaller pieces if the rake is decreased by grinding flats on the cutting faces. This frequently is done for brass.

5. Web thinning sometimes is necessary to reduce end thrust needed to force the point into the work. When the web is too thick at the point, it can be thinned by grinding in the flutes with a formed wheel. An equal amount should be removed from both sides, as it is essential to keep the chisel edge in the center of the drill. Usually, web thickness at the point should be about one-eighth (12½ percent) of the drill diameter. The face of the thinned portion in each flute should be kept as nearly parallel with the axis of the drill as possible. It should not extend more than one-third of the distance across the face of the cutting edge or the rake angle will be reduced too much for efficient drilling.

It is generally agreed that it is virtually impossible to grind a drill by hand with sufficient accuracy. To get the minimum efficiency, drills should be resharpened with properly designed drill grinding machines. This is especially true of drills over ⅜ in. diameter. A perfectly ground drill has been shown to perform 40 percent more work between grinds than the hand-sharpened drills, and the amount of metal removed at each sharpening was less. Frequently drills can be sharpened by machines with smaller relief angles than those usually recommended for the material to be drilled. This is because the recommended angles generally are based on the possibility that the drills will be ground by hand and allowances have been made to insure that it will be sufficient if not accurately ground.

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A

Simple Indexing of Any Angle—XI

BY CHARLES HAVRANEK, FOREMAN, TOOL DESIGN DEPARTMENT, ARMA CORPORATION

HOLE CIRCLES FOR DECIMAL TURNS OF INDEX CRANK

N = Holes per Division. *D* = Appropriate Hole Circle

Turn	0		1		2		3		4		5		6		7		8		9	
	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D
.900	180	200									181	201	172	191	136	151	118	131	100	111
.901	91	101	82	91	73	81			64	71	174	193	165	183	156	173	147	163		
.902	138	153	129	144			120	133	111	123					102	113	158	175	93	102
.903					84	93					178	197	75	83	169	187				
.904	160	177	66	73	151	167					180	199					171	189		
.905	181	200	124	137			153	169	182	201	115	127	163	180	144	159	173	191		
.906	135	149	164	181	29	32	29	32	155	171	126	139			175	193	146	161		
.907	117	129	166	183	88	97	137	151	98	108	157	173	108	119			128	141		
.908	148	163					99	109	119	131	139	153	179	197						
.909			170	187							181	199	161	177	131	144	121	133	101	111
.910	182	200	172	189	152	167			183	201			163	179			143	157	92	101
.911			174	191	154	169			72	79	103	113	165	181			31	34	176	193
.912			83	91			156	171	125	137	167	183	94	103			136	148		
.913	147	161			158	173			116	127			127	139	180	197			138	151
.914	85	93	149	163			160	175	171	187	182	199			118	129			129	141
.915	183	200					173	189	184	201	65	71			76	83			98	107
.916	120	131	131	143	164	179	175	191							165	180				
.917	177	193	166	181	144	157	122	133	111	121	89	97					67	73		
.918	168	183	157	171	146	159			135	147					113	123	181	197	72	81
.919	159	173			148	161					137	149	183	199	126	137	172	187		
.920	184	200					150	163	185	201	139	151	174	189			93	101	163	177
.921			35	38			117	127			176	191	141	153			165	179		
.922	130	141	71	77	178	193	95	103			119	129			167	181				
.923			156	169							169	183	145	157	121	131	182	197		
.924	158	171	73	79					110	119	147	159	184	199	86	93	160	173		
.925	185	200	173	187	136	147	186	201	149	161			112	121	162	175			175	189
.926					138	149			151	163			164	177			177	191		
.927	127	137			140	151			179	193	64	69			77	83	167	180	103	111
.928			155	167	168	181							26	28					183	197
.929	170	183	131	141	105	113	92	99					185	199			159	171	146	157
.930	186	200	133	143	120	129	187	201			174	187	161	173	94	101	148	159		
.931	81	87			176	189	122	131	163	175	68	73	109	117	150	161	41	44		
.932	178	191			165	177	124	133			152	163	180	193			111	119	167	179
.933							168	180							169	181	141	151	113	121
.934	184	197	156	167			128	137	171	183			186	199			43	46	158	169
.935	187	200			130	139	188	201			87	93			160	171	175	187		
.936					132	141	147	157	162	173	177	189			74	79			104	111
.937	119	127	164	175	179	191					135	144					181	193	166	177
.938	121	129	91	97			76	81			168	179			153	163	138	147	169	180
.939			185	197	170	181			93	99			140	149	187	199	125	133	172	183
.940	188	200	157	167	110	117	189	201	142	151			95	101			159	169		
.941					176	187					161	171	129	137			178	189		
.942	65	69	163	173	114	121			131	139	180	191			143	157	165	175	182	193
.943			116	123			133	141	150	159	167	177			67	71	84	89	101	107
.944			186	197					170	180					188	199	171	181	120	127
.945	189	200	86	91	190	201	173	183					139	147	122	129			105	111
.946			158	167	88	93	141	149			177	187	124	131	160	169			107	113
.947	143	151	179	189					162	171					181	191			164	173
.948			183	193							92	97	166	175	111	117			130	137
.949	149	157	168	177	187	197			75	79	94	99	132	139	189	199				

N = Holes per Division. *D* = Appropriate Hole Circle

Turn	0		1		2		3		4		5		6		7		8		9	
	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D
.950	190	200			191	201	172	181	134	141	96	101	77	81			174	183	155	163
.951	136	143			117	123			137	144	98	103					79	83	178	187
.952			159	167					180	189			161	169			121	127		
.953	182	191			163	171	184	193			123	129	144	151	165	173				
.954	83	87	104	109	125	131	188	197					42	44	190	199	169	177	127	133
.955	191	200	85	89	192	201	171	179	150	157			172	180			173	181		
.956	152	159			131	137	175	183			154	161					133	139		
.957	89	93	156	163	179	187	112	117	135	141					181	189				
.958	137	143	160	167	183	191	138	144			185	193	162	169	116	121	93	97	70	73
.959			164	171	141	147			190	197	166	173	95	99	143	149	191	199		
.960	192	200			193	201	145	151	170	177			122	127			147	153	172	179
.961	74	77	173	180	124	129	174	181			25	26			178	183	151	157		
.962	76	79					153	159	128	133			180	187	155	161				
.963	182	189			157	163	105	109	184	191	132	137			186	193			80	83
.964	134	139	161	167			27	28	190	197	163	169	109	113			192	199	165	171
.965	193	200	194	201			167	173			84	87			169	175	113	117		
.966	142	147	171	177			86	89	144	149	173	179			174	180			175	181
.967	88	91			177	183	148	153			119	123			90	93			181	187
.968			152	157			183	189			123	127	154	159	185	191	187	193	158	161
.969	125	129	94	97			158	163			191	197			96	99	193	199	139	133
.970	194	200	195	201			98	101	164	169			33	34			186	171	100	103
.971	168	173			135	139			170	175			172	177			69	71		
.972	139	143	174	179	175	180			176	181	106	109	71	73	177	183	143	147		
.973	78	81			182	187					184	189							186	191
.974	188	193							114	117	153	157	192	197	77	79	194	199		
.975	195	200	196	201	118	121	79	81			159	163	120	123					81	83
.976	163	167			41	42	165	169	124	127			167	171	126	129	169	173		
.977	85	87	171	175			43	44	173	177	87	89	175	179			176	180	177	181
.978	89	91	179	183			45	46	138	139	91	93	183	187	138	141	185	189		
.979	140	143	187	191	189	193			95	97			144	147	193	197	97	99	195	199
.980	196	200	197	201	99	101			150	153			101	103					154	157
.981			156	159			158	161			106	108	160	163	107	109				
.982	164	167			166	169	111	113			168	171	170	173			172	175	115	117
.983	174	177	58	59	176	179	177	180	178	181	119	121	180	183	121	123			184	187
.984			186	189			125	127	188	191	127	129			194	197			196	199
.985	197	200	198	201					135	137	68	69	137	139						
.986	141	143	142	144			72	73	145	147			147	149			139	141	70	71
.987	76	77					155	157	157	159	159	161			161	163	149	151	151	153
.988	165	167	167	169			169	171	171	173	86	87	173	175	175	177	177	179	178	180
.989	179	181	181	183	92	93	185	187	187	189			189	191	96	97	195	197	197	199
.990	198	200	100	101			102	103							106	107	108	109		
.991	110	111			112	113					116	117	118	119	120	121			122	123
.992			126	127	128	129			130	131	132	133			136	137	138	139	140	141
.993	142	143	143	144	146	147	148	149	150	151	152	153	156	157	158	159	160	161	162	163
.994	166	167	168	169	172	173	176	177	179	180	180	181	186	187	188	189	190	191	196	197
.995	199	200																		

STARRETT TOOLS

The Starrett Pledge To Industry

In times of emergency and change such as we are now passing through we deem it appropriate to renew this pledge made many years ago:

To the trade without whose loyal cooperation we should never have attained our present ability to render useful service on a large scale —

To the thousands of skilled workers who use STARRETT TOOLS to make their daily work more effective and productive for themselves, for industry and for their country —

To all who know and love fine tools —

We pledge ourselves to protect and carry on the high standards set by our founder to the end that The L. S. Starrett Company shall continue to merit the distinction of the "world's greatest toolmakers" and that Starrett Tools shall continue to be known and accepted as standard for accuracy the world over.

YOU CAN CONTINUE TO COUNT ON THEM

Starrett Tools and skilled hands just naturally go together. The painstakingly acquired craftsmanship of the "world's greatest toolmakers" puts into a Starrett "Mike", Vernier Caliper, Height Gage, Dial Indicator or other precision measuring tool that certain *feel, handiness, finish* — call it what you will — that the skilled worker recognizes instantly and that inspires speed, confidence and constant accuracy on precision work.

That is why it pays to standardize on Starrett's and to specify them when you order from your supply house.

Now, with 3 Service Stars

THE L. S. STARRETT CO. • ATHOL • MASSACHUSETTS • U.S.A.

World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

Color Code for Machinery Lubrication

AN AMERICAN WAR STANDARD

In 1942, the National Machine Tool Builders Association and the War Production Board requested the ASA to develop an American War Standard Color Code for Lubrication of Machinery. The reason for this request was the serious damage to machine tools and other machinery being caused by the misapplication of given lubricants to lubrication points for which they were not intended, due to lack of proper identification of the contents of the cans or other lubricating devices. It was held that such damage, and the consequent impairment of the war effort, could be avoided if some guide were established to facilitate the correct application of each lubricant. The final draft of the code was submitted by ASA War Committee Z47 to the ASA for final approval, which was given on Jan. 6, 1945.

Scope and Purpose

The purpose of the present Code is to facilitate the application of the proper type of lubricant to machinery.

To achieve this purpose, the code recommends the use of a series of identification colors, supplemented by identification numbers, applicable to:

(*a*) lubrication fittings used on parts or sub-assemblies of machines or other mechanical devices, and

(*b*) lubricant containers and lubricating devices.

Identification System

The identification colors are assigned to eight general classes or basic types of lubricants. Each color is intended to designate a general class of lubricant, but not any specific grade, quality or brand.

The colors listed in the table are recommended by this code for the identification of five general classes of oil and three general classes of greases. It is suggested that those applying this code use identification colors approximating as closely as practicable the colors designated by the Munsell color notations† given in accompanying table.

In some cases the identification color used for a class of lubricant will not stand out against the color of the object to which it is to be applied. The color identification mark should then be shown against a light-gray background of sufficient area to make the color mark clearly visible. It is recommended that this light-gray color approximate as closely as practicable the neutral color designated by the Munsell notation N7/.

If an industrial organization uses more than one kind of lubricant belonging to the same general class, it is recommended that the organization establish its own system of identifying the individual lubricants in that class by giving each of them a number and by marking this number on the color used for the identification of the class. An identification number according to this code is not intended to designate any physical or chemical property of the lubricant, nor any grade, quality, or brand. If containers are not color coded, the purchaser must do it.

IDENTIFICATION COLORS FOR CLASSES OF LUBRICANTS

Class of Lubricant	Identification Color	Munsell Color Notation
OILS		
General Purpose	brown	YR 4/8
Machine Tool Spindle	yellow green	GY 7/10
Gear	purple	P 6/8
Hydraulic	yellow	Y 8/10
Special Purpose	red	R 5/10
GREASES		
General Purpose	light blue	B 7/6
Anti-Friction Bearing	orange	YR 7/10
Special Purpose	pink	RP 7/8

APPENDIX

(This Appendix does not form part of the Code and is intended merely to explain the recommendations made therein)

The ASA War Committee has made no attempt to include in this code definite specifications for lubricants. It was realized that, for example, the viscosity which an oil is required to have varies considerably for different applications and depends, among other things, on the design and surface speed of the parts lubricated, and on the load and temperature under which they operate.

Only by explicit agreement between the supplier and the purchaser of a lubricant shall this code be considered as applying to the marking of lubricant containers, such as drums and cans, by the supplier.

It is not the intention of this code that the application of an identification color to a container, by the supplier of a lubricant, shall put any liability on the supplier for the proper use of the lubricant.

If by agreement between the supplier and the purchaser of a lubricant, the drums are to be marked with an identification color according to this code, the drums need not be painted in that color all over. According to this code, it will be sufficient if the color is applied in a clearly visible patch, for example, a solid circle with a diameter of at least 3 in.

Practical experience has shown that color markings according to the present code may be applied effectively by means of decalcomanias as well as paint.

†*See "Munsell Book of Color" published by the Munsell Color Company, Baltimore, Md. (1929).*

AUTOMATIC SPINDLE CARRIER
LIFTING DEVICE

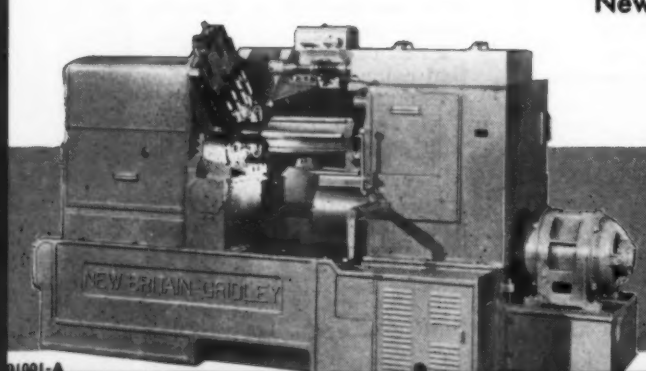
PRESERVES THE INITIAL ACCURACY

New Britains stay on the job... producing untold quantities of fuse bodies, bullet cores, projectiles and other essential components of war materiel for ultimate victory. These Trojans of the Machine Age, employing exclusive features, assure accurate production without frequent adjustment and downtime.

The automatic carrier lifting device is but one of the many outstanding New Britain engineering feats in the world of automatics... eliminating destructive wear... providing permanent accuracy and long life.

Should you be confronted with a production or service problem, look to the New Britain engineer in your area for the automatic solution.

New Britains produce more... better and faster... for less.



THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

Gaging Business

Cancellations Looming

The favorable turn of events in Europe has caused considerable speculation concerning possible cancellations of some of the military orders now jamming the books of machine tool builders. At the end of February, the industry had a backlog of $303,445,000 in machine tool orders, the highest total since September, 1943. The backlog is broken up as $130,000,000 in military orders, $90,000,000 in high-rated Russian business, and $83,000,000 in unrated orders largely required by industry for reconversion.

The War Production Board recently reported that there was some $200,000,000 in additional military business in the offing, but placing of new military orders seems to be at a much slower rate. For example, of the $100,000,000 in business that was to have been placed for the heavy tanks and truck programs, a very small percentage of business has actually been received by tool builders. Unless these orders are placed soon, there will be little hope for delivery of these tools in time to meet the tank production schedules set up by the War Production Board.

Surplus Items Utilized

The slowness of new military business to develop is reflected by the fact that only $40,000,000 in such orders were placed in February, while some $21,000,000 consisted of unrated and Russian orders. Moreover, it is becoming evident that procuring agencies are scanning their surplus and idle tool lists more carefully and using such items to meet their needs, rather than placing new orders. The Army is doing a flourishing business in transferring idle critical tools to other branches of that service as well as to other government agencies. One informed observer doubts that the tank and truck program will bring more than $25,000,000 in new business. Opinion is divided as to the extent of cancellations in the event of a sudden end to the European war.

Since the postwar surplus tool problem will involve a minimum of some 450,000 tools, greater care by the procuring agencies in placing new military orders is a very constructive development. Already, the Army is tagging tools which it expects to keep after the war for its arsenals, stand-by plants, and for storage to meet any emergencies.

Munitions Program Peaking

Despite the difficult goals percentagewise referred to repeatedly by the War Production Board in discussing individual war programs, the fact remains that over-all munitions output will soon pass its peak. WPB has set the peak for July, which is scheduled to top February's showing by 15 percent. Since many critical programs (such as tanks) are not scheduled to reach their best months until late in the year, the over-all July high-point indicates that other programs are passing, or will soon pass their toughest monthly goals.

Cotton-duck passed its peak in March; shipbuilding is definitely on the downtrend; and cuts in some ammunition programs are likely. Large lay-offs in many shipyards are expected in coming months. The Navy's step-up in its shipbuilding program by 84 ships on March 6th was swiftly followed by cancellation of 72 of the planned ships in late March. Since the United States in recent months has increased its number of transferrals of merchant shipping to other Allied nations, there seems to be little chance for any sudden increase in the merchant shipping program.

February Record Good

Although February had ten percent fewer working days than January, munitions production for the month was only two percent below January. Despite bad weather, transportation difficulties and nuisance strikes, critical programs made even a better showing, registering a combined gain of ten percent.

Considering the fact that February was a short month, machine tool shipments also did very well, averaging a 6.8 percent gain over the January daily rate. However, the month's shipments of $36,018,000 were aided by carryovers of shipments delayed by January's bad weather, and were below January's total of $37,353,000. New orders continued well above shipments with February's at $61,823,000, as against January's $61,632,000. Cancellations continued low at $3,799,000 for February, as compared with $3,013,000 for January.

Tool Labor Rising

The industry's manpower situation continues to improve. Tool employment in February amounted to 57,500, a slight gain over January's 56,600. This marked the third consecutive month that employment had improved since November's 1944 low of 55,000. However, employment is considerably down from year-earlier levels of 72,500.

The slight gains in employment will prevent the industry from pushing shipments closer to incoming orders. This means a further climbing backlog, unless heavy cancellations of military orders develop. Observers point out that cut-backs in any programs will permit diversions of tools thus made idle to other war work, thereby tending to intensify total tool cancellations once they begin. Fortunately, non-military orders remain firm.

Rocket Firing Tanks—Sherman tanks such as these, equipped with rocket launchers, helped demolish the Nazi Rhine defenses. The racks holding the rockets are jettisoned after all the rockets have been fired, and the tanks go on with their 75 mm. guns taking over from there

Defense Plant Corporation Machine Tool Inventory Reported

Preliminary survey reveals 239,000 tools owned by DPC in United States. Only small portion already placed on sale. DPC's disposal job will also include some 200,000 other tools when declared surplus by other agencies

WASHINGTON—For its own information, as well as to help industry get a clearer picture of the types of equipment owned by the government, the Defense Plant Corporation has taken a preliminary survey of the machine tools it owns, covering the major tool classifications, according to the government's standard commodity classification. The accompanying tables reveal that the agency recently owned some 239,000 machine tools, but it should be noted that this does not include other metal-working equipment, such as bending-machines, forging equipment, presses and shears, riveting machines, and allied items.

Since the bulk of the equipment is only a few years old, industry has been trying to find out what types of machines DPC is long on, which types it does not have, and over-all how much of it might be usable to industry in connection with its postwar planning. Of course, the machines listed are not available for purchase at present, and will not be until they have been declared surplus. Up to now, only a few thousand machines have been listed on DPC's surplus tool list, and most of these tools had been declared to DPC by other owning agencies.

Other Agency Surpluses

At the end of the war, DPC will not only have the responsibility of liquidating its own machines, listed here, but will probably have to handle some 200,000 additional machines that will be declared surplus by the Army, Navy, Maritime Commission, and other government agencies. Under the Surplus Property Act, DPC was designated as the agency for liquidating all government-owned capital equipment, such as machine tools and industrial plants.

Prospective purchasers of this equipment should be cautioned that a good deal of it is installed in plants owned by DPC, and it is logical to expect that the agency will be more anxious to sell its plants fully equipped, than to strip individual machines out of different plants to make separates sales. Naturally, some plants will be purchased without some or all of the equipment installed, so that DPC will have to make separate sales of equipment installed in entirely owned plants in such cases.

Scrambled Equipment Aspect

On the other hand, some of the equipment listed is installed in scrambled facilities in privately-owned plants. This means that unless the plant in which this equipment is installed chooses to purchase it at the end of the war, these units in scrambled facilities will also have to be thrown upon the general market for sale.

Prices of government-owned equipment were established in mid-1944 (AM,8/3/44,p.124b), but these tools may also be rented under the DPC's "rentra-lease" arrangement. Of the tools listed, DPC had 1,029 out on rentra-lease some time ago, but the number has probably increased since.

Prospective purchasers interested in the equipment listed should consult their nearest RFC office to secure information as to location, age, and condition of such machine tools.

SUMMARY OF DEFENSE PLANT CORPORATION PRELIMINARY SURVEY OF MACHINE TOOLS LOCATED IN THE UNITED STATES

Major Types	Units
Boring Mills	7,985
Broaching Machines	894
Drilling Machines	44,440
Gear-cutting and finishing	8,936
Grinding Machines	61,499
Lathes	47,921
Milling Machines	26,663
Planers	828
Shapers & Slotters	2,348
Keyseating	117
Honing & Lapping	4,049
Polishing & Buffing	8,802
Cut-off & Sawing	6,318
Rifling Machines	212
Tapping & Threading	3,969
Centering Machines	325
Other Machines	9,770
Rentra-lease	1,029
Machine Tool Pool	900
GRAND TOTAL	239,037

DEFENSE PLANT CORPORATION
SPECIAL INVENTORY OF MACHINE TOOLS
LOCATED IN UNITED STATES

DESCRIPTION	Quantity
Boring Machines	
Horizontal Boring, Drilling and Milling Machines	
Table Type under 3" diameter to 8" and over	462
Floor Type under 4" diameter to 8" and over	631
Planer Type (all sizes)	21
Horizontal not elsewhere classified (include special)	488
Vertical Boring and Turning Mills including vertical turret lathes	
All sizes	1,863
Precision Boring Machines	
Single End Horizontal	2,102
Double End Horizontal	946
Special Horizontal	366
Special Vertical	176
Jig Boring and Grinding Machines	
15" to 25"	306
26" to 45" and over	176
Miscellaneous Boring Machines	
Vertical (special)	136
Horizontal cylinder	57
Oil Groovers	13
Boring machines not elsewhere classified	242
TOTAL	7,985
Rentra Lease	33
Machine Tool Pool	84
Broaching Machines	8,102
Internal broaching machines	
Horizontal under 5 tons to 50 tons and over (pressure)	349
Vertical under 5 tons to 50 tons and over (pressure)	213
Special	9

Broaching Machines (Cont'd)	
Surface broaching machines	
Single ram, under 5 tons to 35 tons and over (pressure)	148
Double ram, under 5 tons to 25 tons and over (pressure)	21
Continuous	11
Specials	17
Combination external and internal, all types	67
Broaching machines not elsewhere classified	
All types	59
TOTAL	894
Rentra Lease	3
Machine Tool Pool	12
	909

Drilling Machines

Deep hole drilling machines, all sizes (include rifle drilling machines and rifle drilling and reaming machines)	
Horizontal	365
Vertical	477
Radial drilling machines, plain	
Less than 3' arm, all column sizes	725
3' arm, column under 11" to 11" and over	1,512
4' arm, column under 11" to 15" and over	1,412
5' arm, column under 13" to 17" and over	462
6' arm, column under 17" to 19" and over	409
7' arm, column under 19" to 19" and over	127
8' arm, all column sizes	78
9' arm, all column sizes	39
10' arm, and over, all column sizes	33
Radial drilling machines, wall type	
Power elevating	16
Rigid attached	35
Radial drilling machines, except plain and wall type	
Folding arm type	422
Automatic reversal	326
Type not elsewhere classified	413
Drilling machine, sensitive and power fed upright except bench type (one and more columns, spindles independently fed)	
Drilling capacity in steel or cast iron, under ½", one to five columns and over	8,617
Drilling capacity in steel or cast iron, ½" and under 1", one to five columns and over	9,752
Drilling capacity in steel or cast iron, 1" and under 2", one to five columns and over	2,421
Drilling capacity in steel or cast iron, 2" and over	1,503
Drilling machines bench type	
Under ½" drilling capacity in steel to ½" and over	6,067
Drilling Machines, way and special	
All types	3,415
Drilling machines not elsewhere classified	
All types	5,814
TOTAL	44,440
Rentra Lease	96
Machine Tool Pool	6
	44,542

Gear Cutting and Finishing Machines

Gear hobbing machines	
Gear hobbers up to 48" diameter maximum capacity (single spindle)	1,581
Gear hobbers 48" diameter maximum capacity and over (single spindle)	62
Multiple spindle and special	59
Gear Shapers (spur helical and herringbone)	
Gear Shapers, spur, external and/or internal under 6½" up to 40" and over maximum external diameter of work	931
Gear Shapers, spur, external (only) under 6½" to 40" and over, maximum external diameter of work	461
Gear Shapers, spur and helical external (only) under 6½" to 40" and over maximum external diameter of work	91
Gear Shapers, spur and helical external and/or internal, under 6½" to 40" and over maximum external diameter of work	1,102
Gear Shapers, spur helical and continuous herringbone, external and/or internal (Sykes Type) under 12" to 72" and over maximum diameter of work	102
Gear Shapers not elsewhere classified	368
Gear Cutters and Generators	
All types	1,059
Gear Tooth Grinding Machines	
Generating type	587
Formed wheel type (all types and sizes)	1,055
Gear Grinding Machines not elsewhere classified	442
Gear Finishing Machines except grinders	
Gear Lapping Machines	394
Gear Shaving Machines and enveloping generators	213
Gear Burnishing Machines	46
Gear tooth chamfering and/or pointing machines	106
Gear tooth Burring Machines	13
Combination Gear tooth rounding, chamfering, pointing and burring machines	30
Gear Finishing Machines, except grinders not elsewhere classified	234
TOTAL	8,936
Rentra Lease	36
Machine Tool Pool	4
	8,976

Grinding Machines

External cylindrical, except centerless	
Cylindrical plain grinders, under 6" swing to 60" and over	5,794
External Cylindrical Universal under 10" swing to 20" and over	2,102
Cylindrical roll grinders (all sizes)	103
Semi and full automatic grinders (all sizes)	903
Crank grinders	126
External cylindrical grinders not elsewhere classified	781
External cylindrical, centerless	
Under 4" swing to 4" and over	1,932
Internal cylindrical grinding machines	
Internal grinders, plain or chucking under 8" swing manufacturers' rating to 38" and over	5,101
Centerless grinders, internal (all sizes)	979
Automatic and semi-automatic (all sizes)	648
Planetary internal grinders	69
Combination hole and face grinders	544
Internal cylindrical grinding machines, not elsewhere classified	705
Surface grinding machines	
Rotary table surface grinders, horizontal and vertical spindle under 12" diameter of solid table to 48" and over	3,676
Rotary table surface grinders continuous operation cored table	480
Reciprocating table surface grinders, under 15" length of table travel to 90" and over	3,180
Reciprocating power fedface grinders (length of work table) under 30" length of work table 90" and over	506
Surface grinding machines, planer type	363
Surface grinding machines, not elsewhere classified	1,202
Thread grinding machines	
External, under 6" x under 20" maximum diameter and length of work 12" and over X all lengths	2,016
Internal, under 9" maximum diameter to 12" and over	257
Combination external internal	188
Thread grinding machines not elsewhere classified	192
Special tool and cutter grinding machines	
Tap grinders	433
Keller cutter grinders	455
Drill Grinders	1,265
Drill point thinner	146
Gear cutter grinders	478
Broach grinders	257
Face Mill cutter grinders	414
Single point tool grinders (includes so-called carbide tool grinders)	3,323
Miscellaneous special tool grinders	1,661
Universal tool and cutter grinders	
Under 8" maximum diameter of work to 12" and over	4,051
Disc, face and stand grinders	
Disc grinders	2,635
Stand and snagging grinders under 7½ hp to 7½ hp and over	2,682
Bench grinders	3,737
Swing frame grinders	748
Face and stand grinders not elsewhere classified	1,080
Grinding machines miscellaneous (do not include abrasive cut-off machines)	
Grinding machines not elsewhere classified	6,287
TOTAL	61,499
Rentra Lease	230
Machine Tool Pool	223
	61,952

Lathes

Lathes, engine and tool room	
Lathes up to 24" swing, including tool room lathes, under 30" to 60" and more center to center	11,884
Lathes 24" and over swing including tool room lathes under 60" to 20' and over center to center	1,302
Gap lathes, maximum swing under 24" to 24" and over	168
Bench type and light duty lathes (less than 1 hp) include bench turret lathes and bench hand screw machines	5,560
Turret lathes ram type (include hand screw machines except bench type)	
Standard, under ¾" to 2½" and over round bar capacity	8,495
Special	598
Turret lathes saddle type	
Standard, under 3" to 10" and over round bar capacity	4,443
Special	663
Automatic chucking and between center lathes	
Automatic chucking machines, single spindle, under 4" to 30" and over maximum chucking capacity	1,970
Automatic chucking machines, multi-spindle, two to eight spindles and over	1,261
Automatic between centers, lathes, single spindle, multi-tool under 4" to 30" and over maximum swing diameter	1,314
Automatic chucking and between centers lathes, not elsewhere classified	651
Automatic screw machine, single spindle (bar)	
Single-spindle, bar capacity under ⅝" to 6" and over	3,423
Automatic screw machines, multi-spindle (bar)	
Four spindles, under ⅜" to 6" and over bar capacity	373
Six spindles, under ⅜" to 3" and over	2,109
Eight spindles under ⅜" to 2" and over	129
Multi-spindle, not elsewhere classified	239
Artillery, ammunition and boring lathes	
Shell turning lathes, maximum diameter of finished shell under 4.1" or 105 m.m. to 11.1" and over	139
Boring lathes including gun boring and turning under 24" swing to 72" and over swing	89
Cartridge case trimming and head finish lathes 1.1" shell to extra-types and sizes	10
Artillery and ammunition lathes, not elsewhere classified	1
Lathes, not elsewhere classified	
All types and sizes	3,100
TOTAL	47,921
Rentra Lease	321
Machine Tool Pool	163
	48,405

Milling Machines

Milling machines, bed type	
Single spindle automatic up to 15" table travel, horizontal under 6" to 15"	1,698
Single spindle automatic, over 15" table travel, horizontal 15" to 72" and over	2,949
Double spindle (duplex) automatic horizontal, under 30" table travel to 72" and over	491
Vertical spindle, bed type, under 15" table travel to 72" and over	946
Milling machines, bed type, not elsewhere classified	532
Milling machines, knee type, horizontal	
Plain horizontal, knee type, under 28" table travel to 50" and over	4,671
Universal, knee type, under 28" table travel to 50" and over	1,074
Manufacturing, knee type, horizontal	190
Knee type, horizontal, not elsewhere classified	168
Milling machines, knee type, vertical	
Standard size, vertical under 28" table travel to 50" and over	3,327
Manufacturing, knee type, vertical	219
Knee type, vertical, not elsewhere classified	213
Milling machines, universal head and ram type	
Under 28" table travel to 50" and over	1,063
Milling machines, thread (thread hobbers)	
External under 2½" maximum swing diameter to 10" and over	482
Internal (all sizes)	186
External and internal under 4½" to 10" and over	464
Planetary (all sizes)	295
Automatic (all sizes)	157
Thread millers, not elsewhere classified (inc. special)	141
Milling machines, bench and hand	
All types and sizes	2,081
Profilers and contour; die sinkers, duplicators, cam and engraving millers	
All types and sizes	2,839
Milling machines, planer type	
Under 36" x under 36" maximum height and width of work, which can be machined to 72" and over x 72" and over	117
Miscellaneous milling machines	
Milling machines not elsewhere classified	2,360
TOTAL	26,663
Rentra Lease	244
Machine Tool Pool	247
	27,154

Planers

Double housing (include convertible)	
Under 36" x under 36" maximum height and width which can be machined to 120" and over x 120" and over	376
Open side	
Under 36" x under 36" to 72" and over x 72" and over	191
Crank Planers and Shaper Planers	
All types	130
Plate Planers	
All types	11
Planers, Miscellaneous	
Pit type	8
Breast type	10
Planers not elsewhere classified	102
TOTAL	828
Rentra Lease	11
Machine Tool Pool	55
	894

Miscellaneous Machine Tools

Shapers and slotters except gear shapers	
Horizontal shapers under 13" stroke to 37" and over	1,565
Vertical shapers and slotters under 7" stroke to 20" and over	476
Special shapers (all sizes)	307
Keyseating machines	
Maximum width under 1" to 4" and over	117
Honing and lapping machines except gear honing and lapping	
Honing machines (all types)	1,704
Lapping machines (all types)	2,167
Honing and lapping machines	165
Honing and boring machines	13
Polishing and buffing machines	
All types	8,802
Cut-Off and sawing: Contour sawing and filing machines	
Cut-Off and sawing machines, power, hack type, under 12" x 12" to 12" x 12" and over	2,032
Cut-Off and sawing machines, rotary cold saws under 12" to 12" and over	916
Abrasive Cut-Off Machines	896
Band saw type machines	2,480
Lathe type Cut-Off Machines	59
Pipe cutting machines	101
Cut-Off and sawing machines not elsewhere classified	782
Contour sawing and filing machines	1,984
Rifle working machines, except drilling	
Rifle reaming machines	83
Rifling machines	79
Rifling and drilling machines	1
Rifling, reaming and drilling machines	1
Rifle chambering machines	48
Tapping and threading machines	
Threading machines, general	733
Pipe threading machines	587
Bolt threading machines	162
Threading machines not elsewhere classified	229
Nut tappers	336
Shell tappers	44
Tapping machines not elsewhere classified	1,878
Centering machines	
All types and sizes	325
Machine Tools not elsewhere classified	
All types and sizes	9,770
TOTAL	37,942
Rentra Lease	55
Machine Tool Pool	106
	38,103
GRAND TOTAL	239,037

Detroit Letter

Reconversion Interest Lags

Washington's reawakening to the fact that reconversion may soon be a subject of importance to the country hasn't caught on in the automotive capital. There is a general tendency to "let Washington do it now."

Ever since the machine tool order was tossed out of the window by WPB, the automotive chiefs have been glum. Machine tools are still the all-important element in going back to car production and with no appreciable relief on that as yet, they are not paying much attention to what is being done in Washington.

To say WPB has taken on cognizance of the machine tool situation would not be strictly accurate. It has to the extent that it is now trying to encourage prime contractors, who sub-contracted to machine tool builders while the latter's commitments were falling off, to take back the work where possible and free the machine tool builders for their regular work. Where the prime has had capacity to do this, it has been done. But the instances are too few and far between to show any remarkable results.

Postwar Auto Talk

Only the sales end of the automotive industry appears to be doing any talking or predicting on the postwar automobile. Latest to sound off is Jack Davis, general sales manager of the Ford Co.

Davis recently told a local trade paper that the public "would be surprised" by the postwar car. He predicted many changes, principally in the engine, bearings, hardware and ornaments. On the outside, he saw few changes.

This is contrary to what production men in the industry have said. The latter see different body work and fenders but little underneath the hood.

The tool and die industry, running at about 75 percent of capacity, is proof of no extensive tooling program. Any radical changes in cars are placed as far away as 1947, at the earliest.

In the ordinary course of events, mechanical changes are usually tested at the proving grounds for from 12 to 15 months before making their appearance in models. Even if improvements are now being experimented with, it would mean that they could not be placed in production until late in 1946 or in 1947.

The sales talk may be a move to counter-act the feeling among the buying public that it will not want the first cars off the production lines but will wait for the improved models to follow.

Draft Curbs Research

The revised Selective Service regulations are also not conducive to experimenting or improvements in present models. Engineers under 30 are very vulnerable. They have been before but are even more so now.

Under the old War Manpower Commission ruling that the auto companies could use up to 1 percent of their employment on postwar work, the manufacturers gained little help. One firm found that six out of seven of the men it had picked to do some experimental work were of draft age and immediately lost their deferments through the change.

Less Labor Trouble

The labor front has simmered down since the upheaval caused by the Mead committee's visit. Occasionally a flareup indicates that the truce is but temporary and shallow. The firing of several sleepers at Continental Motors recently occasioned a tieup. Fortunately, it was short-lived.

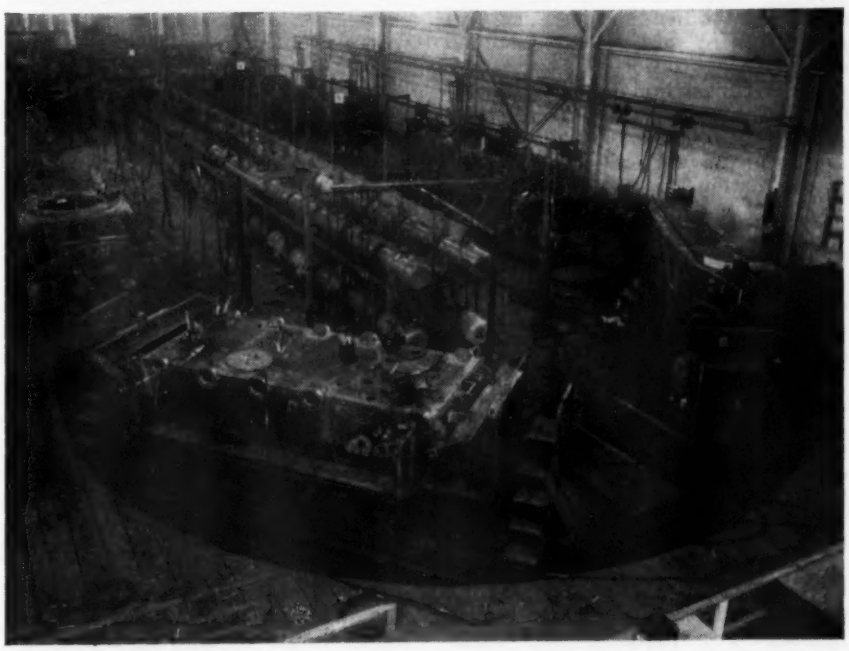
The result of the new status of foremen in the shops is being watched carefully by both sides. Privately, management is disturbed by the ruling giving the foremen the right to collective bargaining. The Foremen's Association says now there will be more permanent peace in the shops. The UAW-CIO is saying nothing, maintaining its hands-off attitude which it assumed at the beginning of the organization work by the foremen.

TESTING POSTWAR ENGINES?

DETROIT—One of the large automobile companies is making tests of five aircooled passenger car engines. Cars with such power plants are being driven in the city streets, says a well-informed source. If adopted, these motors would bring about radical retooling of engine plants.

A rear-engined model will be built by an independent. Designs for a newly styled car to seat six people are being handled by an outside engineering concern while the customer proceeds with a high volume of war work. The engine planned for this car will have six-cylinder, horizontal opposed engine, in which the block will be of aluminum. Large weight savings are anticipated.

The two-cycle engine has received considerable attention for possible automotive uses. Some experimental cars of well known makes have mounted such engines. Another engine under development with only 36 moving parts will produce exceptional power.



Cadillac's Welding Loop—Known as the "merry-go-round," this welding loop at Cadillac Motors enables welders to reach every section of M-24 tank hulls as they revolve slowly around the loop

Business, Labor Leaders Draft Postwar Peace Charter

Presidents of U. S. Chamber of Commerce, AFL, and CIO, reach compromise expected to stave off postwar industrial strife and prevent government interference

WASHINGTON — The first basic agreement between industry and labor to cooperate in their postwar relationships was revealed at a joint press conference held by Eric Johnston, president, U. S. Chamber of Commerce, William Green, president, American Federation of Labor, and Philip Murray, president, Congress of Industrial Organizations. It is reported that the basic reasons for the agreement are: (1) the unions wish to protect their wartime gains; (2) industry wished to stave off any further swing to the left on the past labor; and (3) both industry and labor prefer to bargain with each other without government compulsion.

The agreement incorporated the following points: (a) encouragement of productive efficiency and technological advancements for the steady improvement of the standard of living; (b) respect for the rights of private property and freedom of action; (c) recognition of management's right to manage; (d) recognition of the right of labor to organize and bargain collectively without hindrances; (e) cooperation in protecting the individual against unemployment, old age, and physical impairments; (f) increased foreign trade with reasonable assistance to other nations; and (g) establishment of an international security organization. For these purposes, business and labor agreed to establish a national committee, composed of representatives of both groups to "advance the best interests of our nation."

Broad Adoption Possible

Although the "charter" represented an agreement among the Chamber, the AFL and the CIO, it was hoped that it would eventually be supported by the National Association of Manufacturers, the railroad brotherhoods, and other independent unions. Henry Kaiser was admitted to be an important sponsor of the plan. Its signers declared that the charter is by no means a "perfect instrument", but that it was "a beginning."

The committee is to eventually have either 15 or 20 members. Of these, twelve were immediately designated: For industry—Mr. Johnston; Paul G. Hoffman, president, Studebaker Corp.; Henry J. Kaiser; Otto A. Seyfarth, president, West Michigan Steel Foundries; E. J. Thomas, president, Goodyear Tire & Rubber Co.; J. D. Zellerbach, president, Crown-Zellerbach. For Labor—Mr. Green; Mr. Murray; George Meaney, secretary-treasurer, AFL; Robert J. Watt, international representative, AFL; R. J. Thomas, President, UAW-CIO; Sidney Hillman, president, Amalgamated Clothing Workers, CIO.

WARNER & SWASEY'S EARNINGS DROP 70%

CLEVELAND—The net profits of Warner & Swasey in 1944 dropped 70 percent from 1943's showing. Earnings amounted to $502,358 in 1944, as against $1,696,270 in 1943, while sales were dropping from $50,969,974 to $23,908,328. Charles J. Stilwell, president, stated that 1944 was a year of conversion for the company, as it entered production of direct war items, causing a considerable financial loss.

Industry Drops Long Work Week As BLS Reveals Efficiency Drop

CLEVELAND—An accelerated trend away from excessively long workweeks is taking place in metal working industries in the wake of Bureau of Labor Statistics studies indicating that such schedules do not yield the greatest output. War Manpower Commission reports show that weekly hours are shrinking toward the wartime minimum of 48, and have reached a general level of 54 to 56, down from the 66, 72 and occasional 84 encountered a year ago.

The Bureau of Labor Statistics has published the results of exhaustive studies in 12 metal working plants which had instituted marked changes in working schedules, and whose production records enabled a reasonably accurate check of effects. In general it was found that factories may obtain greatly increased output for short periods by drawing on the reserve strength of workers. But over long intervals, absenteeism increases, accidents are more frequent and efficiency drops until total output from long hours might actually be less than that obtained under a shorter schedule.

8-hour Day Efficient

The evidence indicated that the 5-day week and 8-hour day were most efficient, but addition of a sixth day of 8 hours resulted in a little loss in efficiency. Lengthening of hours beyond this number brought a sharp break, primarily by wiping out the tendency to build up to a peak of efficiency in the middle of the week. The clear conclusion was that workers adjust themselves to longer hours by slowing down, not because they wanted to, but because they have to.

The undesirability of continued Sunday work was illustrated by records of one plant which showed a 36% gain in efficiency when Sunday work was dropped after a year's trial. In terms of its performance, the 7-day week amounted to 8 days' pay for 5 days' output.

Longer Hours Wasted

For the hot, strenuous work of a forge shop, a 52-hour week was to be as productive as a 58-hour week. In a shell plant, an increase in working hours from 40 to 66 brought only a 7% increase in output, a result which could have been attained by increasing the work week from 40 to 44, without the waste of the extra 20 hours. The plant is now on 48 hours.

It was significant that the drop in efficiency with increased hours was more marked under incentive-wage systems. For men on straight day-work rates, the level of efficiency was virtually unchanged by raising daily hours in a 6-day week from 8 to 9½. The conclusion drawn was that the pace at the shorter hours was far enough below peak that the extra hours caused no slowing down.

No General Maximum

The BLS surveys made clear that there is no generally-applicable optimum hour schedule for industry. The wage system, the degree to which workers can control the speed of operations and the requirement of the job govern the selection of the most efficient schedule. It is evident, however, that the long hours instituted in many plants under wartime pressure were an economic waste, and that the reduction trend now under way is likely to continue when peace comes regardless of production demands.

DPC's "Rentra-lease" Covers $20,000,000 in Equipment

WASHINGTON—It is reported that over $20,000,000 in production equipment, including machine tools, owned by the Defense Plant Corporation is now out on "rentra-lease" to war contractors and sub-contractors with approval of major procurement agencies. The "rentra-lease" represents the rental of equipment previously acquired by DPC for war purposes only at a rental of 1 percent of the value of the item per month. This rate is substantially below the standard commercial rentals.

DPC will also make rentals to private concerns without limiting the use of tools to war work, but in its "commercial" rental form involving a monthly charge of 1½ percent monthly. In such cases, if the contractor wishes to use the machine currently for war work, approval of the contracting agency must be secured prior to the rental being made. If the contractor wishes to use the machine for approved civilian production, then approval of WPB must be secured. Naturally, the shortage of certain types of critical tools has limited the number of "commercial" rentals by DPC to a very small number.

DPC stresses that neither lease involves option to purchase by the lessee, and rentals paid will not be credited against future purchase prices. The "rentra-lease" has been in existence for about a year-and-a-half, and largely involves used government-owned equipment.

Complaints Diminishing

Until a short time ago, some contractors were complaining that it took too long to get the lease made out; that in some cases the lease was delivered some six months after the leased equipment had been installed. However, this lag in paper work has been greatly reduced by DPC in recent weeks.

Another complaint by prospective lessees is something about which little can be done: contractors interested in leasing a particular government-owned machine take it up with their district representative of the particular procurement agency, who then takes it up with his headquarters in Washington, D. C., who take it up with DPC headquarters there, who checks it with other critical requirements for such equipment. If the item is still available by that time, then word must be passed along the same channel in reverse. This means that in many cases contractors are unable to secure the machine they knew was available to begin with. The services say that this cannot be helped, since it is necessary to continue to divert equipment to those places where it is most urgently needed.

Cutting Tool Manufacturers to Handle Government Surpluses

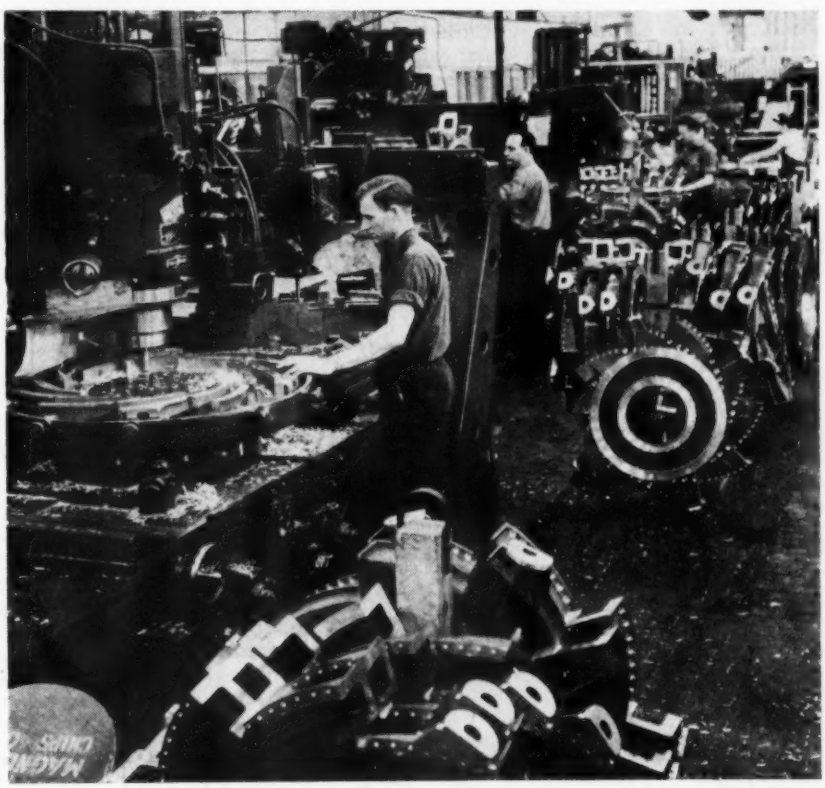
WASHINGTON—The Defense Plant Corporation's proposal that surplus government-owned cutting tools be handled through the original manufacturers has been approved by the Surplus Property Board, with no objection by the Department of Justice. The Reconstruction Finance Corporation, of which DPC is a subsidiary, is the disposal agency for capital equipment, such as cutting tools.

Under the plan, contracts will be made by the government with the cutting tool manufacturers who would be paid a 17½ percent commission on sales, provided that he agrees to fill 25 percent of all his orders from government-owned surplus stock. The manufacturer would also be paid for the cost of handling, reworking, reconditioning, and storing the cutting tools prior to resale. The contract may be terminated by either party on ten days' written notice.

The Surplus Property Board declared that this plan seemed to be the most feasible solution to the gradual liquidation of the large surpluses in cutting tools owned by the government without throwing the industry into chaotic conditions. It was stated that the plan would enable the industry's 235 manufacturers to stay in business, and maintain their employment, since they would be meeting 75 percent of their orders with new cutting tools, as industry gradually absorbed the huge surplus in the remaining 25 percent ratio.

FORD TO DROP AVIATION AFTER WAR, MAY KEEP WILLOW RUN

DETROIT—It is generally admitted here that Henry Ford will get out of the aviation industry after the war, even though the giant Willow Run plant has reached a productivity stage of one four-engine bomber a day. However, Ford would like to take over the government plant, and if he does, he does not plan to junk any of the equipment at Willow Run, and may use the plant to produce farm implements. Willow Run is equipped with some 4,300 machine tools and some 11,000 jigs and fixtures.



Milling Jet Engine Parts—This view of a section of the production line at General Electric's Lynn, Mass., plant shows the machining of parts for the G-E Jet Engine. Regarded as the most powerful aircraft engine in the world, the G-E Jet was designed and developed in this plant to power the Lockheed P-80 fighter (the Shooting Star)

Romney Proposes Laws to End Privileged Status of Unions

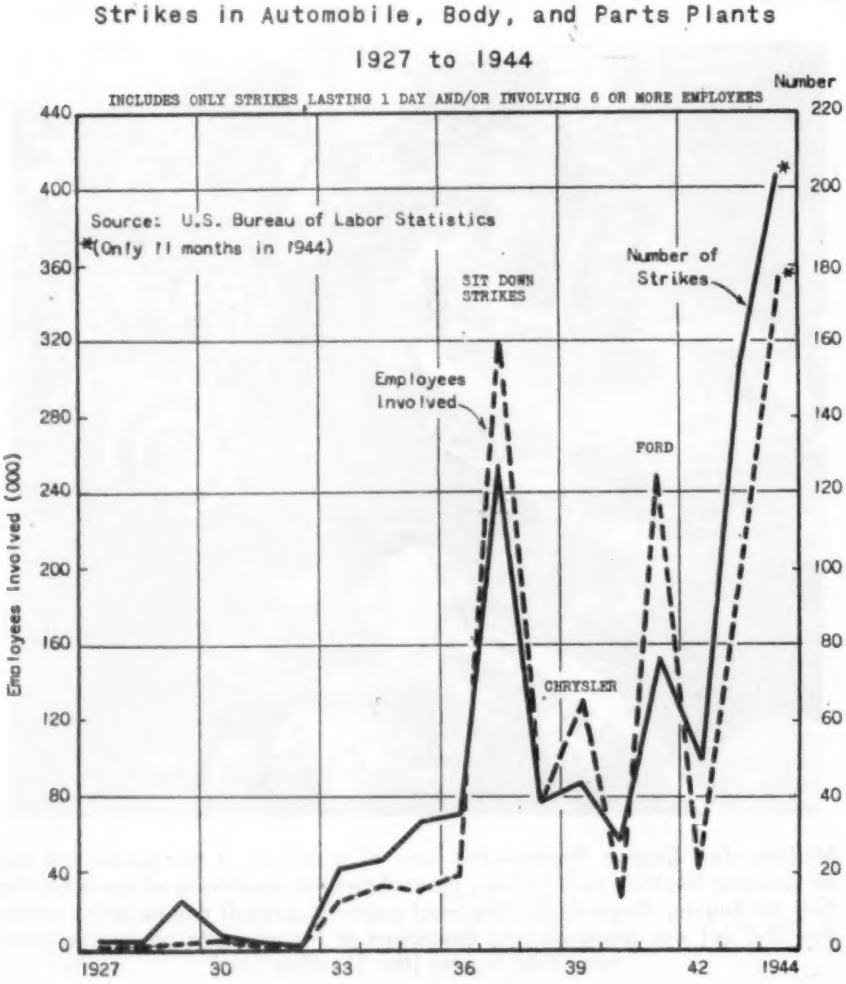
DETROIT—In his presentation before the recent Mead Committee hearings, Mr. George Romney, Managing Director of the Automotive Council for War Production, urged the congressmen "to put an end to the privileged status of unions and their representatives and their exemption from basic laws and principles with which other Americans comply." He recommended the adoption of a "national labor policy strengthened, completed, balanced and modernized to establish a foundation for the management-labor relationship essential to the country's future."

Mr. Romney charged that the unions were trying to usurp management's functions and that this was why the CIO-UAW was actively backing and supporting the organization of foremen into the Foreman's Association of America. He denounced the union for fomenting strikes, largely over disciplinary matters without resorting to established grievance procedures. He pointed out that in the first 11 months of 1944, there were more strikes in the automobile plants than in 1937.

Violence Cited

Mr. Romney related a long series of incidents showing workers' defiance of foremen and management representatives. In one case, a foreman was thrown out of a door by two workers, merely because the foreman had been assigned to that department to replace another foreman who was incompetent. In another case, 300 howling workers beat up a small group of labor relations men and plant guards, destroyed office records, and other office items. A crew of welders struck six times in four days to try to force the ouster of another welder. A stoppage results when a worker is disciplined for making a knife in the furnace during working hours. These incidents, and many others cited, in his opinion evidence union support of violation of shop rules and collective bargaining agreements. He stated that 43 percent of 1944 strikes were the result of union efforts to defeat maintenance by management of orderly working conditions to keep required production levels.

Mr. Romney believes that a "militant minority" has been the cause of most of the labor difficulties in the industry. He therefore proposed adoption of national labor policy which would: (1) retain or restore to management its right to manage; (2) protect workers from coercion on the part of the management and by unions; (3) impose penalties on unions which strike before exhausting grievance procedures; (4) localize the handling of labor-management policies, instead of centralizing them in Washington; (5) provide for decentralization of union-management relations; (6) separate unions should be protected against the undue concentration of power in the international unions; (7) the encouragement of the incentive pay system; (8) the unions themselves should pay union stewards or committeemen or other union officials for time spent on union business.



FEBRUARY ABSENTEEISM EQUALS 15,708 WORKERS' PRODUCTION

CLEVELAND — Production of 15,708 workers was lost in the Cleveland region during February as a result of absenteeism, according to a report by Associated Industries. This figure far exceeds any estimate of the total manpower shortage here for sometime past, and sustains some contentions that if absenteeism were wiped out there would be no manpower problem.

Whipp, Monarch's President, Predicts Favorable Prospects

SIDNEY—Confidence in the postwar market for machine tools was expressed by Wendell E. Whipp, president, Monarch Machine Tool Co., in his letter to stockholders accompanying the company's annual report. Mr. Whipp stated, "Looking to the future, there has been much talk about the great overproduction of lathes and other machine tools for war, with a consequent destruction of the peacetime market for years to come. A logical appraisal discounts much of this kind of thinking."

Mr. Whipp pointed out that intensified use of machine tools by inexperienced hands during the war will require replacement of a good many of them after the war. In addition, retention of some war plants in postwar operation will withdraw large numbers of tools from the market, while foreign industrialization will add to the demand for tools.

Washington Bulletin

Byrnes on Reconversion

The quiet government preparations for VE-Day were finally revealed in James F. Byrnes' final quarterly report as he resigned as Director of the Office of War Mobilization and Reconversion. Byrnes said Army cut-backs after VE-Day would be 20 percent immediately and five percent more in each of the next four quarters. Lack of information on Navy and air force plans prevented any prediction on their cut-backs.

Material limitation orders will be relaxed by WPB on VE-Day, except in extremely short items such as lumber, chemicals and containers. A simple priority system will be substituted, while spot authorizations will be expanded. Moreover, Byrnes predicts that unemployment after VE-Day will be temporary, and suggests that public works projects to create employment should be postponed. Proposals embodied in the report included: (a) merging the Army and Navy into a single National Defense Department; (b) continuing price and wage controls after VE-Day; (c) separation of the Surplus Property Board from the OWMR, and amendment of the surplus property act as soon as feasible; (d) partial refunding after VE-Day of postwar credits provided under the excess profits tax law; and other points.

New Rubber Czar

John L. Collyer

Drafted from his presidency of B. F. Goodrich Co., Mr. Collyer will head up the critical rubber program for three months, under direction of WPB chairman, Krug. Rubber is in the most critical position since Pearl Harbor

Signs of Spring

Quiet rearrangements are going on behind the scenes in many war agencies. New personnel is being added, and old personnel is being dropped or kicked upstairs.

The publicly announced changes have been few. Gen. Lucius D. Clay, deputy to James F. Byrnes, Director of War Mobilization and Reconversion, resigned to join the staff of Gen. Dwight D. Eisenhower, as his deputy in charge of civil affairs for the future occupation of Germany. Gen. Clay's resignation had been predicted for weeks with Washington gossip blaming it on the fact that he was "unacceptable" to labor.

Mr. Mason Britton, Surplus Property Administrator, and former chief of WPB's Tools Division, resigned his post to undertake a confidential government assignment. Before leaving the Surplus Property Board, Mr. Britton helped develop some of its broad policies, such as the arrangement for disposal of surplus cutting tools.

Meanwhile, the good war news has stimulated attempts by various other agencies to justify their postwar continuation.

Differences Over "Pit"

The RFC reports that its tool trading pit (AM, 3/1/45, p. 128e) is very successful. The pit is an arrangement whereby representatives of the Army, Navy, WPB and RFC meet daily to redistribute idle government machine tools before they are declared surplus. RFC states that through the efforts of the pit, 4,463 tools have been sold, transferred, or leased to contractors for war work through the efforts of the pit. However, insiders say that many of these tools were never really "dealt in" in the pit, but were withdrawn by the agencies originally declaring that they were idle. In other words, the long lists of tools that the trading agencies eagerly examined as being "available" later turned out to be unavailable. As a result, one of the major agencies has only been able to secure one or two tools daily from the "pit".

One thing that the trading pit is accomplishing, however, is the screening of new orders against the list of available used tools. This guards against the ordering of new tools, when suitable used ones are available. In addition, the services are asking lessees of their equipment to list such items which are idle, so that they may be added to available tool lists.

Walter E. Joyce, vice president of DPC, is chairman of the Executive Committee, comprised of representatives of the major procurement agencies, which oversees the entire operation and solves special problems. Roger A. Wilson, chief of DPC's Machine Tool Section, is chairman of the Review Committee, which handles the apportionment of idle tools from day to day.

THE FIRST 300 BILLION

WASHINGTON — Congress approved raising the National Debt limit from $260,000,000,000 to $300,000,000,000. Senator Taft (R., Ohio) demanded that the government immediately survey postwar financing, and advised getting back to a balanced budget as quickly as possible if postwar inflation is to be stopped.

Allied Tools Help

It is reported that Canadian tool builders have taken on some of the more urgent tool orders to help out American tool builders. Thus far, the Canadians have turned out about 550 lathes of the heavy ammunition program.

Additional relief to our munitions programs has been forthcoming from the return of lend-lease tools to the United States from Great Britain. It is reported that such tools are being returned, even though title to them has been transferred to the British Government under the recently announced sale.

The urgent military demands upon the American tool industry has stymied France's attempt to secure a favorable priority upon its requirements for rehabilitation purposes. It has already been reported that the French are seeking some $100,000,000 in machine tools, but they know that there is little point in placing orders without priorities. Despite this, firm inquiries have been made and tentative arrangements set up, pending the receipt of a priority.

Army's Redistribution Efforts

The Army's Redistribution & Salvage Branch of the Ordnance Department has been doing some good work in getting its idle critical tools redistributed. It issues regular weekly listings to some 1,200 Army, Navy and other service representatives and field inspectors. This list contains descriptions of critical tools currently available in the Army's jurisdiction. Services interested in those tools can phone the branch in Washington.

Spotting the Air News

Radar Prospects Broad

Radar has already accomplished a profound change in air and sea warfare, and it has advanced the outlook for progress on postwar civil aviation by many years. In war, as in peace, radar makes all the difference between knowing at a glance where ships and planes and other things are, instead of having to guess or go scouting, or ask by radio. Of course, in the case of the enemy, he won't tell.

Army and Navy tried to hold the clamps on radar completely, but they did not succeed, because technicians all over the world know how it works. Early in the war, the British explained what their aircraft ranging and detecting system could do. They didn't say how, but radiomen figured it out in no time. All radar applications depend upon the returning echo of radio signal. The direction of the return shows the projected line on which lies the object from which the signal bounced back, and the time required shows the distance. The location of airplanes and ships of both friend and foe are shown on a screen, and their progress can be traced. Echoing sound waves have been used for centuries to measure distance to obstructions; for instance, fogbound fishermen merely yell or toot their whistles.

Improvements Continuing

Germany and Japan have radar; they know the principles well. The trick now is to develop more sensitive and dependable equipment. American manufacturers and military technicians are trying to do that, with a will. It is these refinements which are not only restricted, but confidential. Nothing whatever can be said about them. The enemy knows of course that many ships in Allied navies and many airplanes are equipped with electrical eyes that can see in light, dark or storm.

When enemy ships and planes succeed in coming within gun range, radar locations and tracing of their courses is converted into fire control. The aiming of anti-aircraft guns on aircraft moving swiftly at close range as in attacking surface ships, becomes a matter not of eye work but of geometry and automatic computation. Of course, radar direction can miss, because it cannot predict changes in course of the enemy objective. But it is so good that enemy planes, approaching an objective in reasonable numbers, are usually downed before they can take effective action.

Postwar Radar Uses

The principal hope of civil aviation in radar is traffic control and collision warning. Army and Navy have just lent ten carloads of radar equipment to the Civil Aeronautics Administration for experimentation at its Indianapolis laboratory.

For one thing, CAA wants to develop a radar screen that will enable airport control tower operators to visualize the position of every airplane within a 25-mile radius of their fields. Such facilities would permit tower operators to coordinate landing priorities farther in advance of actual arrival, and it would permit them to adjust the flow of departing traffic against incoming traffic.

Collision Warning

Collision warning is still more important. Radar is ready to be applied in horizontal angles. It has already been applied in vertical angles, to serve as an altimeter recording altitude above the ground. Barometer altimeters merely record altitude above sea level. Radar probably can be made to register universally, in all directions. Such a device would reveal all the passing contours of the ground, like a pantagraph, and all objects in the air, in all directions from the plane bearing the instrument.

Collision warning equipment will be a valuable auxiliary to safety devices already in use in the commercial airplanes. Most accidents result not from mechanical failure of airplanes, but from pilot error hitting unseen obstructions, including the ground, while in normal flight. But it will be even more important to non-professional pilots who do not have time to learn elaborate air instrumentation. In fact, radar collision warning, including the altimeter feature, could be a chief factor on which a really large aircraft industry will depend.

Flying Repair Shop—The Air Technical Service Command has developed long-range efficient repair planes, designated to service and repair B-29s where AAF maintenance depots are few and thousands of miles apart. This is an interior view of a C-46 Curtiss Commando fully equipped and with additional accessories stowed in the center prior to its flight to the Pacific to serve as a "flying repair shop"

Curtiss Helped Produce 37% Of Total U.S. Plane Output

NEW YORK—Curtiss-Wright Corporation has produced 25,000 planes since January 1, 1938, and produced engines and parts for 75,000 more. Total U. S. plane production up to the end of 1944 was 266,677 planes.

Names in the News

The annual meeting of the board of directors of the American Society of Tool Engineers, held in Detroit, March 23-24, elected the following national officers for the coming year: president, **C. V. Briner,** manager, Gage & Tool Div., Pipe Machinery Co., Cleveland, Ohio; first vice president, **A. M. Sargent,** president and general manager, Pioneer Engineering & Mfg. Co., Detroit, Mich.; second vice president, **W. B. Pierce,** vice president of research and development, Flannery Bolt Co., Bridgeville, Pa.; third vice president, **Thomas P. Orchard,** general manager, American Tool Engineering Co., New York, N. Y.; secretary, **A. M. Schmit,** general manager, A. M. Schmit Co., Toledo, Ohio; treasurer, **W. J. Frederick,** president, Frederick Steel Co., Cincinnati, Ohio; and assistant secretary and treasurer, **W. A. Dawson,** chief inspector, Otis-Fenton Elevator Co., Ltd., Hamilton, Ontario, Canada.

E. C. Gyllensvard

E. J. Reardon

Eric C. Gyllensvard has been appointed export sales manager of Farrel-Birmingham Co., Inc., Ansonia, Conn. and Buffalo, N. Y., with offices at 3700 Chrysler Building, New York, N. Y. Mr. Gyllensvard has been with the Standard Oil Co. and the Sullivan Machinery Co., in their export divisions. He has also served in an advisory capacity on various government committees handling export controls during the war.

Eugene J. Reardon has been elected vice president and director of the Superior Steel Co., Pittsburgh, Pa., succeeding **David Pryde,** retired. Mr. Reardon has been with the Geometric Tool Co., New Haven, Conn., and the American Steel & Wire Co. in its various divisions. Last year he was named chief engineer of the latter firm.

Bernard Gould, formerly in charge of dip tank sales, has been appointed general sales and advertising manager of the Aeroil Burner Co., Inc., West New York, N. J.

R. N. Flippin

Commander Royce N. Flippin, USNR, has been appointed executive director of the Navy Industrial Association, 101 Park Ave., New York, N. Y., which was formed last summer to maintain and perpetuate the close relationship which has been built up between the Navy and industry during the war. A graduate of Annapolis, Commander Flippin served for nine months after Pearl Harbor as personnel advisor to the Secretary of the Navy before returning to active duty with the Navy. He was previously associated with Brown Harriman & Co. and was later district manager of the U. S. Gypsum Co. in Philadelphia.

Frank P. Rhame recently was elected president and general manager of the Lunkenheimer Co., Cincinnati, Ohio to succeed the late **Eshelby F. Lunken.** At the same time, **Homer E. Lunken** was elected first vice president and assistant general sales manager and **Harry A. Burdorf** was elected vice president in charge of sales.

George Ericson has been appointed head of the patent department for the American Car and Foundry Co. and its associated and subsidiary companies. Mr. Ericson has been in charge of patents and new developments for Carter Carburetor Corp., an ACF subsidiary, since 1928.

Nicholas Gerten, managing director of the Compagnie Francaise Blaw-Knox when the Germans overran France in 1940, is preparing to resume his work in the French organization, a subsidiary of the Blaw-Knox Co., Pittsburgh, Pa. Mr. Gerten has been with Blaw-Knox since 1927 and in 1932 went to France where he supervised all Blaw-Knox interests in continental Europe for seven years, before being named director in 1939.

David A. Nelson, who has been manager of the West Coast plant of Detroit Broach Co. for the past year and one-half has now returned to Detroit as vice president and general manager of the company. Before joining Detroit Broach, he had been associated with Colonial Broach Co. for 18 years.

W. E. Mullestein, acting assistant sales manager for Lukenweld, Inc., has been granted a leave of absence to serve in an overseas capacity with the U. S. War Department.

William F. Stamets has been appointed sales engineer for the Special Products Div., Lodge & Shipley Machine Tool Co., Cincinnati, Ohio. Mr. Stamets was formerly quality control engineer for the Standard Steel Spring Co., St. Louis, Mo.

E. W. Romig, chief engineer of the Claud S. Gordon Company's Cleveland plant since 1938, has been appointed vice president in charge of the Cleveland district of the firm. Prior to his association with Gordon, Mr. Romig was connected with the Aluminum Corp., Western Electric and the Muzak Corp.

John E. Ponkow, formerly chief electrical engineer and supervisor of experimental engineering for the Federal Machine and Welder Co., Warren, Ohio, has been appointed sales manager of the company. Before joining Federal in 1941, Mr. Ponkow was associated with Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

J. E. Ponkow

E. W. Romig

C. P. Pesek has been appointed administrator of engineering of Minnesota Mining & Manufacturing Co., St. Paul, and **W. A. Thomas,** assistant chief engineer, has been named engineering consultant on Mr. Pesek's staff.

Bernard S. Meade, former executive sales manager of the American Swiss File and Tool Co., Elizabeth, N. J., has been elected vice president and director of the firm to succeed **Philip Schaeffer** who has retired because of ill health after 20 years with the company.

Marcel C. Boss has been appointed chief engineer in charge of design and production operations of the Optimus Equipment Co., Matawan, N. J. Before coming to the United States in 1942, Mr. Boss was an engineer with the Carrier Engineering Co. in London and Paris until he established his own firm, the Mabor Co. in Paris. Since 1942, Mr. Boss has been with Hanson-Van Winkle-Munning Co. and the Optimus Co.

OBITUARIES

Vincent Bendix

Vincent Bendix, 62, founder of the Bendix Aviation Corp. and president of Bendix Helicopters, Inc., died suddenly March 27 at his home. After 30 years in the automotive industry when he invented such improvements as the Bendix drive, which made practicable the self-starting of automobiles, and introduced into this country the first volume production of four-wheel brakes, he established the airplane corporation bearing his name. Mr. Bendix was a former president of the Society of Automotive Engineers.

Joseph F. Shepherd, manager of the Service Engineering Dept., The Sheffield Corp., Dayton, Ohio, died unexpectedly at his home March 18. Mr. Shepherd had been with Sheffield for 22 years in various capacities, having been appointed to his present position several years ago.

Lester F. Gilbert, 60, vice president of the Tube Manifold Corp., Buffalo, N. Y., passed away recently.

John W. Rathbun, 73, general manager of the S. W. Card Manufacturing Co. until his retirement in 1942, died January 16. Mr. Rathbun started with the company as bookkeeper in 1892 and was later their first salesman representing the firm. From 1921 until his retirement, he held the position of general manager.

Clifford G. Brockman, president of the Smith and Mills Co., Cincinnati, Ohio, passed away March 12. Mr. Brockman had been associated with the company for over 30 years.

Donald N. Mussen, 46, head of sales and research engineering at Trico Products Corp., Buffalo, N. Y., passed away recently. Mr. Mussen had been associated with the company for 22 years.

Herbert R. Allen, 49, New York district manager of the Square D Co., died March 14 in Mt. Vernon, N. Y., after a prolonged illness. Mr. Allen joined the Square D Co. in 1922 and served in many sales capacities until he was appointed to his New York post in 1934.

John R. Morse, 66, management engineer, passed away March 21. Mr. Morse had been with the government as an industrial engineer for many years, and for some time he has been management engineer at Wright Field, Dayton, Ohio.

Nevil M. Hopkins, 71, inventor and engineer, passed away March 25. Dr. Hopkins was president of National Electric Ballots, Inc. and served as consulting engineer for several other firms. He was known for his inventions such as a submarine capable of carrying a 16-in. gun; long-range naval and anti-aircraft guns; high explosive anti-aircraft shells and battleship wrecking bombs. At the time of his death, he was working on plans for new types of submarines, destroyers, rockets and rocket guns for the Navy.

BUSINESS ITEMS

The International Nickel Co. has formed three new sections of the **Development and Research Div.:** the **Industrial Chemicals** section, headed by **O. B. J. Fraser;** the **Corrosion Engineering** section, with **F. L. LaQue** in charge; and the **Non-Ferrous Casting** section, headed by **Donald J. Reese.**

Eclipse Counterbore Co., Detroit, Mich., has appointed **Arthur R. Shevlin** as New England sales and service representative to succeed **H. F. Miller.** Mr. Shevlin's headquarters will be located at 238 Park Square Bldg., Boston, Mass.

The Yoder Co., Cleveland, Ohio, will be represented in the Michigan area by a direct factory branch, with offices in the Maccabees Building Detroit, Mich., with **E. C. Murdock** as manager of the new office.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has re-appointed **F. S. Cockburn** field representative in Peru. Mr. Cockburn, who served as Peruvian representative for several years prior to the outbreak of war, will be located at Casilla 2233, Lima, Peru, S. A.

The Ohmite Manufacturing Co. has made an initial grant of $15,000 to the **Illinois Institute of Technology** to be used for the establishment of a laboratory for the precision measurement of electric and magnetic quantities. This initial contribution will be used to equip what will be known as the Ohmite Laboratory for Precision Measurements, which will be constantly expanded as new equipment becomes available. The ultimate goal of the laboratory is to provide precision electrical measurements for the Chicago area approaching in accuracy those of the Bureau of Standards in Washington, D. C.

Walter Kidde & Co., Inc., Belleville, N. J. purchased the capital stock of the **Youngstown Miller Co., Inc.,** formerly of Sandusky, Ohio as of January 10. Orders on hand will continue to be filled by **F. L. Gerin,** who becomes vice president and general manager. Other new officers of the subsidiary include: **John F. Kidde,** president; **Harold A. Cartier,** vice president; **G. Crosby Hiss,** secretary; and **William Deyerberg,** treasurer and comptroller. **R. E. Strobel** will continue as sales manager for the Youngstown Miller products.

The newly organized **Black Manufacturing Co.** has taken over the **Alexander Milburn Co.** of Baltimore, Md. The new organization will operate under existing patents and patents pending of the former Alexander Milburn Co.

The **W. G. Kerr Co.,** Pittsburgh representative of the **Foote Bros. Gear and Machine Corp.,** Chicago, Ill., the **Reeves Pulley Co.,** Columbus, Ind., and others has moved its office to 520 Oliver Bldg., Pittsburgh 22, Pa.

The Star Machinery Co. has opened a new branch in Portland, Ore. with **Gordon W. Hauck,** former representative of the firm in Seattle, Wash., as manager of the branch.

The Luscombe Airplane Corp., Trenton, N. J., has purchased a tract of about 500 acres of level farmland in Texas near Dallas on which to erect an aircraft factory and develop a complete new airport.

Connors-Joyce, dealing in technical manuals, training films and visual aids, has opened its executive and production offices at 18 E. 41 St. New York, N. Y., under the management of **René G. Varley.**

K. O. Lee Co. Aberdeen, S. D., has appointed **Harry A. Wehmeyer, Jr.,** 6923 Roberts Ave., University City 14, Mo., as factory representative in Missouri and the southern half of Illinois.

Dresser Industries, Inc., formerly of Bradford, Pa., has opened new centralized administrative offices for 18 plants of its member companies at 1130 Terminal Tower, Cleveland, Ohio.

The Bone Tool & Gauge Co. has recently moved from their old plant into new, enlarged quarters at 9910 Freeland Ave., Detroit 27, Mich.

Shop Equipment News

Landis Tool Co. Hydraulic Grinder Has Universal Wheel and Headstock

Exact and sensitive controls enable the type H hydraulic universal grinder made by the Landis Tool Co., Waynesboro, Pa., to produce continuously with exceptionally close work tolerances. The grinder resembles the 4x18 type H plain machine; the major differences are the universal wheel head and universal headstock. The bed is a rigid box type with integrally cast compartments for the coolant reservoir, control, hydraulic and electrical equipment. The bed design prevents headstock or footstock overhang at any position of the carriage. The V and flat guides are constantly lubricated by a metered amount of filtered oil.

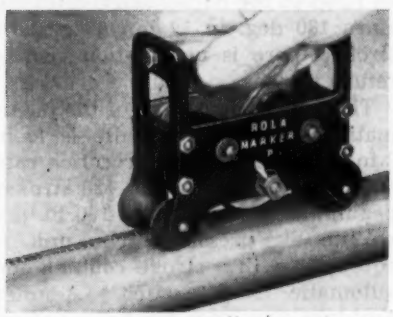
The headstock is driven by a constant-torque variable - voltage motor with a work speed range of 90 to 600 r.p.m. It drives the headstock through V-belts. Starting and stopping are controlled by the work control lever. The headstock spindle and work drive pulley are mounted on preloaded precision ball bearings. Change from live to dead spindle is made by a convenient plunger and provision is made to swivel the head up to 90 deg. for face grinding.

The grinding wheel head is mounted on a sub-slide and swivel base. It can be swivelled 90 deg. in either direction and moved 4 in. forward or backward to obtain additional work clearance. All guides are lubricated by a one-shot system.

The hydraulic system consists of a transverse cylinder, a direct connected vane type oil pump and control valves. Smooth traverse speeds of 3 to 120 in. per min. are possible with a reversal accuracy of 0.001 in. The control mechanisms, hydraulic and electrical equipment in the base are accessible by means of removable side panel covers.

Rolamarker Prints Size and Alloy on Round Metal Stock

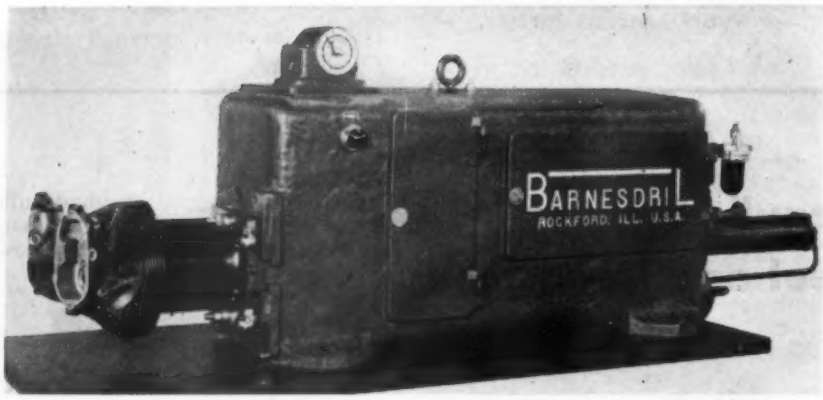
A marking tool for applying painted designations to tubes, bars, pipes or rods is manufactured by Adolph Gottscho, 190 Duane St., New York 13. The printing cylinders and roll guides are mounted in an aluminum housing and passed along the length of the piece to be marked. The die cylinder is preceded and followed by "V" rollers for guiding the impression to the top of the round metal piece, eliminating the possibility of running off the top of the tube or pipe. For changes in diameter there is a simple adjustment made by means of opening a wing nut, setting an indicator and then tightening the wing nut. One model



Rolamarker

covers the range of diameter variations from ⅜ to 2 in.; another from ¾ to 3 in. With the Rolamarker, permanent dies, interchangeable complete dies or parts of dies or interchangeable individual type pieces may be used in the die cylinder as the imprinting medium. Permanent inks can be used for metals—light inks for dark metals or black for light metals. Wherever possible black ink should be used for best imprinting results. With this device metals must be free of grease or oils.

Pneumatic Ram Drives Barnes Piston Ring Lapping Machine



Barnesdril ring lapping machine

A piston-ring lapping machine for use in radial aircraft engine building operations is manufactured by the Barnes Drill Co., Rockford, Illinois. The machine is a pneumatically operated horizontal piston type suitable for bench use.

The ram spindle has a false engine piston attached to carry a full set of rings. The rings are compressed and the radial cylinder barrel is placed on the false piston, releasing the rings to normal wall pressure. The cylinder barrel is then clamped to the mounting face of the machine. The machine reciprocates the mounted rings in the barrel and rotates the rings 180 deg. in 12 in. of forward stroke; there is no rotation on the return stroke.

The adjustable stroke of the pneumatically operated spindle is from 2 to 12 in. and the reciprocation rate is adjustable from 25 to 120 strokes per minute, operating on 100 lb. per sq. in. air pressure. The unit is equipped with a stroke counter and automatic stop switch. Adapter bushings are used for holding barrels of various diameters.

Plasteel Rust Inhibitor for Protection of Machined Parts

A rust inhibitor designed for the protection of ferrous alloys from atmospheric moisture and chemical vapors between machining and heat-treating operations, is manufactured by the Plasteel Corporation, 3900 West Jefferson Avenue, Ecorse 18, Michigan. A concentrated powder, it is mixed with water in proportion of 2 to 3 ounces of 303 compound per gallon of water. Normally, the solution is applied in a pickling or washing machine as the last rinse before drying. Best results are obtained by operating at a temperature of 160 to 200 F. The material can protect against humid or acidic atmospheres during processing and temporary storage indoors, but it is not intended for stock that is exposed to the weather. It is removed by a water rinse. It is supplied in barrels containing 100 or 300 lb. of concentrated dry powder.

Portable Test Set Supplies Test Voltages up to 15,000

A portable a.c. test set, mounted on a three-wheeled truck so it can be moved and plugged into any convenient 115- or 230-volt, 60-cycle outlet, and capable of supplying stepless test voltages from 0 to 15,000 volts, is manufactured by the General Electric Co., Schenectady, New York. Though only 36 in. high, 49 in. long, and 30 in. wide, the set has a capacity of 5,000 volt-amperes and can be used for accurately testing generators or large motors of approximately 1,500 hp., transformers up to several thousand kva., short lengths of power cable, insulators and other pole line hardware.

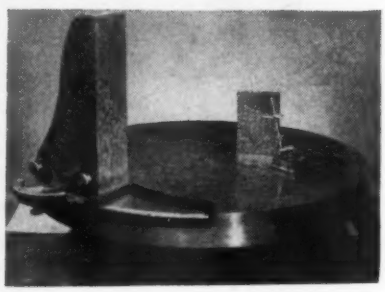
GE test set

The complete equipment consists of a set-up transformer; built-in electric timing clock; double-scale switchboard-type voltmeter; voltmeter scale selector switch; air circuit breaker with instantaneous overload trip; built in a case inclosing all energized parts. A 15-ft. supply cord and plug, and two 15-ft. shielded high-voltage leads with insulated test handles are also included.

With the exception of a safety foot-switch that shuts off the high voltage when released, all controls are mounted on an inclined control panel.

Circular Layout Plates Give Greater Accuracy and Speed

The MLM radial layout plate has horizontal and vertical reference lines and graduations in degrees permanently machined into the surfaces of the circular plate; this arrangement makes each plate a 360 degress protractor in itself. When used in conjunction with special attaching protractors and angle plates, a flat reference surface in any of three planes may be obtained. The outer edge vernier guide attachment has a vernier to permit adjustment of an angle plate surface to minutes of a degree to the main reference lines. The outer guide protractor permits the angle plate surface to be adjusted and maintained to compound angles to the reference lines.



MLM radial layout plate

The use of the radial layout plate and attachments permits accurate reproduction of models, patterns or tools to blueprint dimensions. The plates are supplied, including necessary attachments, by the Contour Company, 43 E. Green St., Pasadena 1, Calif. in 24 or 96 in. diameters. Other sizes of layout plates with matching attachments or special equipment are made to order.

DO IT WITH A DUOMATIC

Accuracy and uniformity are essential in cutting V-grooves in V-belt sheaves. This assures proper belt seating, equal pull, and maximum transmission of power.

With the Duomatic—Lodge & Shipley's full automatic lathe—you get accuracy and uniformity PLUS exceptional speed in production. For on the Duomatic, dual carriages and tool slides permit far greater multiple tool operations, front and rear... cut many more sheaves at the same time.

Illustrations show L & S Duomatic Lathes in the light duty sheave department of the Dodge Manufacturing Corp., Mishawaka, Indiana. Multiple tools, front and rear, cut 5 V-grooves at one time in Dodge precision-built D-V Sheaves. As groove shapes and pitch diameters must be identical Duomatics are used to meet every precision requirement and to effect outstanding savings in production time.

Call on L & S Engineers to show you how the Duomatic can do a better, faster job on V-belt sheaves. For detailed literature, write on your company letterhead for Bulletin 601.

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U. S. A.

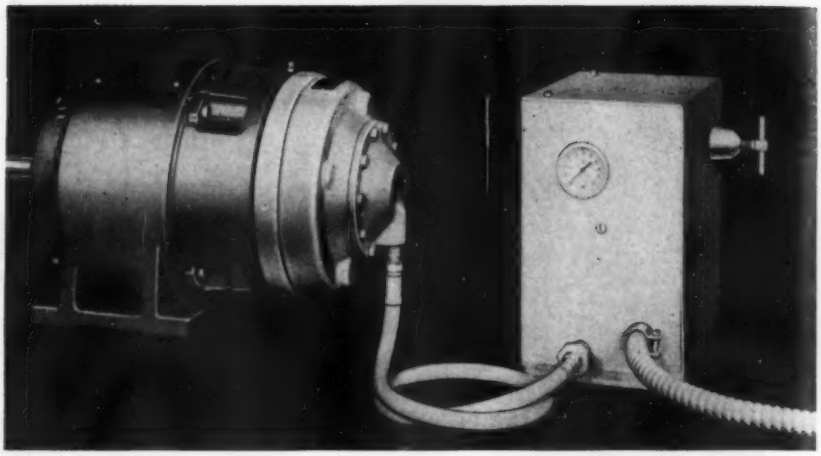
L & S LATHES

ENGINE—TOOL ROOM—AUTOMATIC—OIL COUNTRY LATHES

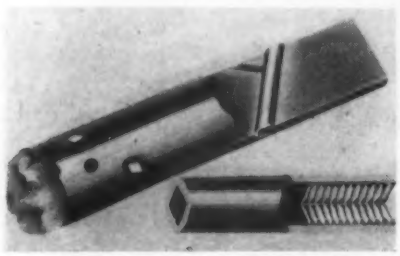
Pneumatic Disk Brake With Adjustable Torque Control

The James L. Entwistle Co. of Pawtucket, R. I., manufactures pneumatic disk brakes for use on motors or on any other rotating equipment where a quick, smooth stop is required. These include an adjustable torque-control unit which permits instantaneous adjustment of braking torque from any remote position without change of brake adjustment.

The Entwistle brake is about one-half the size of comparable electrically operated disk brakes, yet has a smooth operating brake torque four to eight times greater. The brake requires no lubrication and requires no adjustment during the life of the friction disk. Complete absence of packing insures against loss of air through leakage. These brakes are available with or without Entwistle control unit in single, double or triple disk with torque ratings of 100, 200 and 300 lb. ft. for operation at pressures up to 125 lb. per sq.in. for use on N.E.M.A. brake frame motors and on any other rotating machinery.



Entwistle brake



Sturdy boring bar adapter

Square Holes in Boring Bars Provided by Sturdy Adapter

A means of putting square holes in boring bars is provided by boring bar adapters manufactured by Sturdy Broaching Service, 13414 Fenkell Avenue, Detroit 27. A Sturdy Boring Bar Adapter is fastened in a drilled hole in the boring bar. This adapter consists of a round sleeve with a square hole broached through the center. One end of the hole is tapped for a back up screw.

To install the adapter in a boring bar, a hole of the proper size and at the desired angle in the bar is drilled and reamed. Then the adapter is inserted in the hole. The adapter can be sweated, welded or soldered into position. After the adapter has been set in place a hole can be drilled and tapped for the set screw through the sleeve and bar simultaneously.

The adapter is replaceable when the edge of the hole becomes broken down or torn.

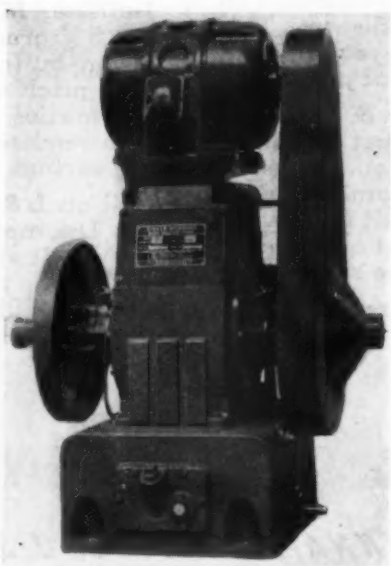
Sturdy Boring Bar Adapters are available for use with ¼, ⅜, ½, ⅝ and ¾ in. bits. They may be had finished to standard size on the O.D. or with approximately 0.015 in. grinding stock.

High Volumetric Efficiency Provided by Microvac Pump

A pump designed to produce and maintain vacuum as low as five microns absolute pressure in continuous service, is manufactured by the F. J. Stokes Machine Co., Philadelphia 20, Pa. The 212 E Microvac, an oil-sealed rotary pump, is smaller, lighter in weight, simpler in design, more rugged, and has both higher volumetric efficiency and greater capacity than the model it supersedes. The pump is rated at 100 cu.ft. displacement at 350 r.p.m.

This pump employs four internal moving parts; a shaft with keyed-on eccentric, a rotating one-piece piston and slide, and the hinge bars. This design eliminates dead space or clearance, permitting the discharge of air at the end of each stroke to be complete. There can be no re-expansion to impair pump efficiency. The only valve, on the discharge side of the pump, is sensitive to pressure differentials and made to discharge, without injury, sudden slugs of water or other liquids which may be sucked into the pump. The valve seat is of stainless steel.

The pump is motor driven with V-Belt drive and motor mounted on an adjustable hinged base. Floor space requirements are held to a minimum by using a top-mounted motor. Pulley is balanced to act as a flywheel and assure smooth operation. Oil baffles are built into the base to remove entrained oil from the exhaust. A centrifugal oil clarifier can be supplied, and is recommended to remove condensed moisture or foreign matter continuously from the sealing oil before it is returned to the interior of the pump.



Microvac pump

Cutting Speeds Increased With Cast-Steel Tool Bit

A solid cast steel cutting tool bit manufactured by Cobalt, Inc., 1340 N. Main St., Ann Arbor, Michigan, is produced by melting a cobalt steel alloy in an indirect arc rocking electric furnace, superheating to above 3,000 F. and casting in molds of the approximate tool size. This process gives the metal a preferred grain and carbide particle size at the time of casting, thus eliminating the need of forging and later heat treating.

The process results in a tool that will retain its cutting ability on many types of work several times longer than has been considered possible. Cutting speeds can safely be increased by 20 percent. Powersteel solid steel tool bits are supplied hardened and ground. They are available from stock in nine standard sizes of square bits and five sizes of rectangular bits.

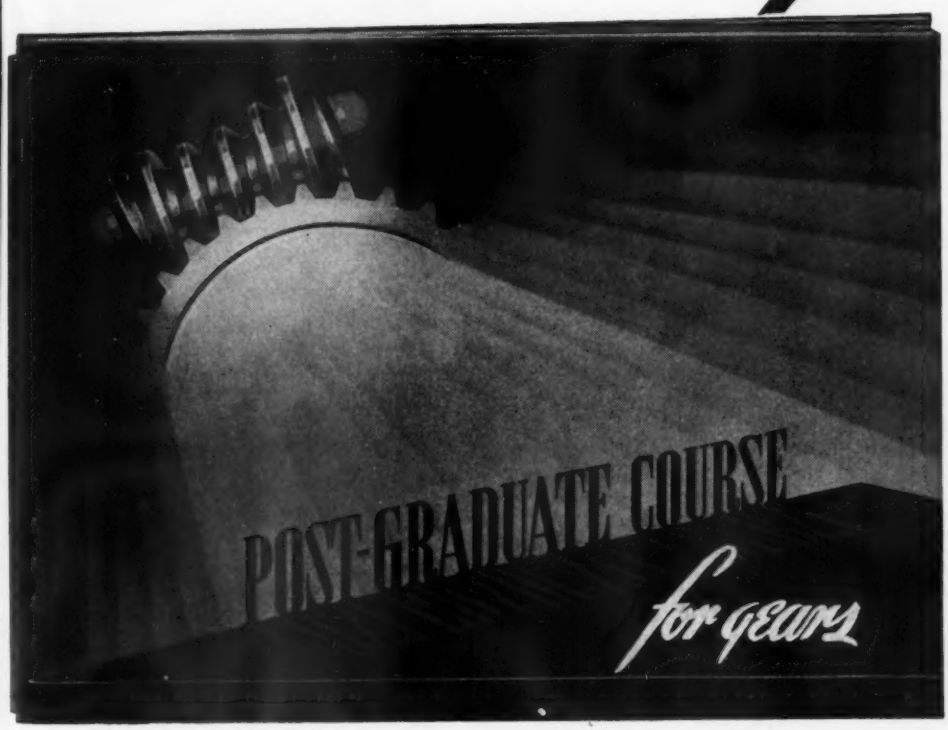
Gears?

READ THIS!

Among the new ideas in design which in the crucible of mechanized War, have achieved records exceeding even the hopes of their most enthusiastic supporters is Cone-Drive gearing.

It has taken a war to prove that Cone-Drive's pre-war promises could be fulfilled and repeated time after time in unequalled records of increased load carrying ability, longer life, decreased wear, vast savings in weight and space, etc., as compared with other forms of gearing.

What some of these records are and what they may mean tomorrow in the design of new products is told in a 20-page booklet now available to those engaged in developing new products for war or peace-time use.

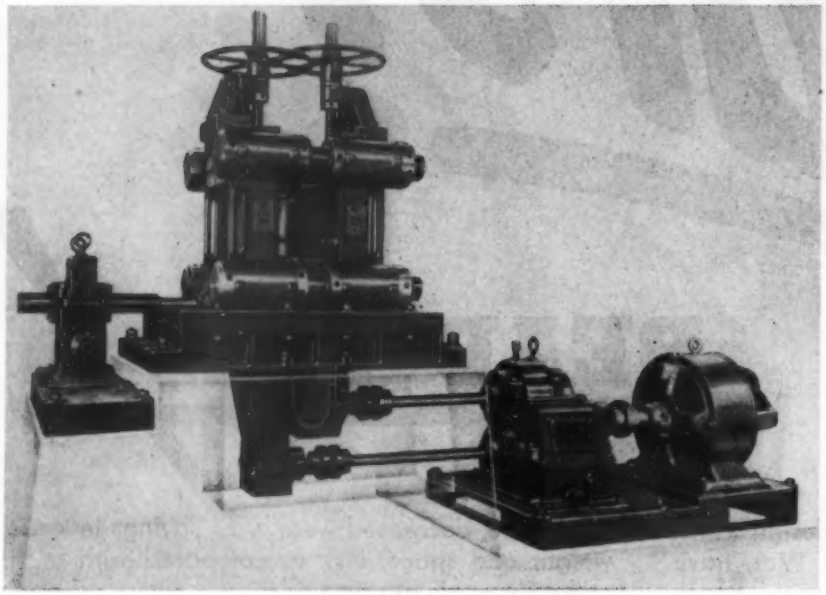


Ask for Booklet 745

Also available: Manuals
CW-41B (For executives)
CW-41A (For design engineers)

CONE-DRIVE DIVISION **MICHIGAN TOOL COMPANY**
7171 E. McNichols Road, Detroit 12, U. S. A.

Vertical Precision Mill Rolls Rounds to Accurate Tolerances



Mackintosh-Hemphill precision mill

Using commercial tolerance bar stock, the vertical precision mill built by Mackintosh-Hemphill Company, Pittsburgh, Pa., rolls accurate rounds ⅜ to 1½ in. in diameter within cold-drawn tolerances. Provision has been made so that it can be set up to edge shapes and flats.

The mill stand consists of a pair of vertical rolls, located immediately after the finishing stand of the tandem mill train. The roll stand can be moved horizontally to line up the pass line with any pass in the horizontal rolls of the finishing stand. The rolls can be adjusted vertically, so that any pass of the vertical rolls can be lined up with any pass of the horizontal rolls in the tandem mill. Roll housings of the precision mill are also adjustable with respect to each roll to control the size of the product.

The rolls are 12 in. in diameter by 15 in. long and are supported by anti-friction roll neck bearings in a cast steel carrier. The carrier is adjustable vertically in a cast steel housing and is locked in place to eliminate any movement due to rolling pressures. This housing is connected to a similar housing, holding the opposite roll, by means of four heavy columns. Distance between the roll housings is adjustable by nuts on both sides of one housing. When an adjustment is made and the nuts tightened, the two roll assemblies are practically one unit. Vernier scales are provided on all adjustments to make possible accurate control of the size of the roll pass.

The stand is mounted on ways in a heavy base, and is adjustable horizontally by means of a screw jack, which is operated by an electric motor and worm gear drive.

The mill is driven by a 100 hp. direct current, mill-type variable-speed motor. The rolls are positively driven by a special pinion stand through individual mill spindles and bevel gear drives. The rolls can be removed by disconnecting the coupling box and lifting out the complete roll carrier through the top of the mill stand.

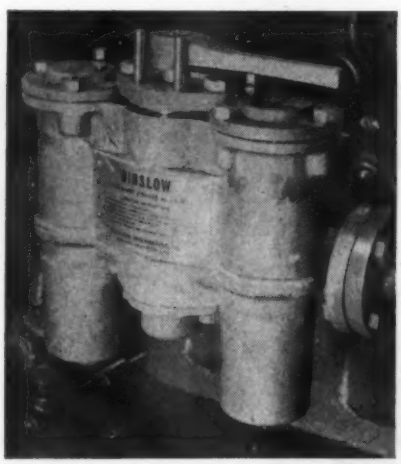
Twelve Indexing Positions Provided with Enco Turret

All Enco square turret toolposts manufactured by the Enco Mfg. Co., 4522 Fullerton Ave., Chicago 39, have 12-position indexing or three individual working positions for each tool. Spaced at 30 deg. apart, this 12-position indexing device permits each tool to perform more than one operation. For example, a facing tool can be used for turning, and if necessary, an inside or outside chamfer. Twelve-position indexing also provides a quick set-up for threading. Complete jobs may be set up at one time, eliminating tool changes and lost time in second-operation set-ups on production or toolroom jobs. Standard ground tools and standard boring bars can be used. Twenty-two different models cover almost all lathe swings from 6 to 36 in. Machinable base models for quick adaption can be shipped from stock or turrets can be made to specifications. The use of special tool-designed holders designed to fit the operations required permits the twelve position indexing turret to be used for intricate jobs that would ordinarily require several individual set-ups.

Magnetic Separator Removes Oil-suspended Metal Particles

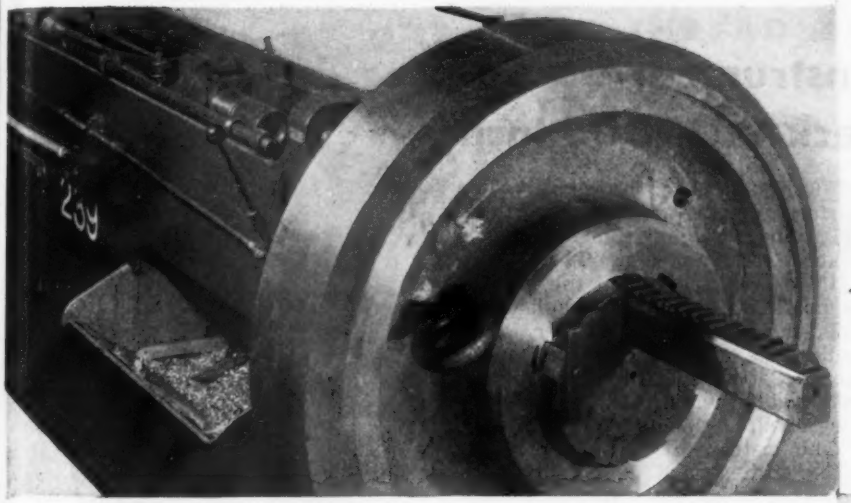
For use in lubricating oil lines to remove filings and metal particles through the combination of magnetic action and screening, a strainer manufactured by the Winslow Engineering Co., Oakland, Calif., combines in one unit the by-pass valves, pressure regulator, main control valve, and the two strainer elements in which powerful magnets are located. A hand-operated three-way control valve permits the change of flow from one strainer element to the other, or through both elements. The flow control valve has been simplified and requires no jacks to lock it in place. Adjacent to this three-way valve is the pressure regulating valve, for adjustment of out-going oil pressure.

The Model 200-MS-1 Winslow Duplex strainer is of either cast bronze or iron for the one-piece body which incorporates the manifold, the strainers, inlet and outlet connections. The two cylindrical baskets are constructed around a main body of perforated steel, within which are fine wire mesh linings. The magnets are suspended within the baskets.



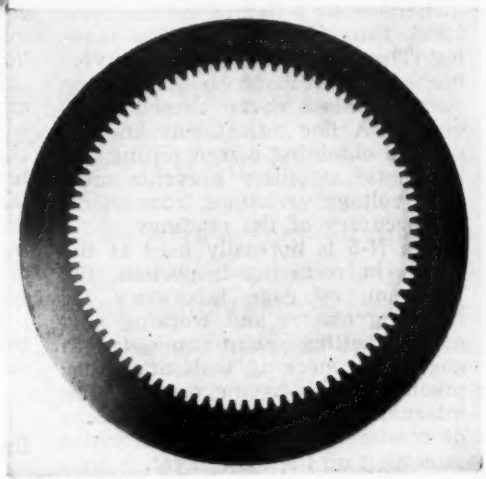
Winslow strainer

In the body is located a spring loaded by-pass valve that may be adjusted from the outside. The Model 200-MS-1 is designed to handle 15 g.p.m. A larger model to handle 40 g.p.m. is also available. Where finer filtration of the lubricating oil is necessary, cartridge oil conditioners may be used in conjunction with the strainer.



Left. Broaching these large splines one at a time on a Colonial Universal Horizontal proved the lowest cost process for machining them. These 12" I. D. splines had to be held to exceptionally close tolerances (0.0005 total spacing error).

Below. Teeth on these clutch discs are broached 9 teeth at a time, indexing between cuts, but 13 discs are broached at one set-up. Broach cost is much less, output actually larger. Machine and broaches are Colonials.



How much does Broaching cost?

The answer to that question lies in "how" you broach it. In *high* production the major factors usually are machine time and broach life. Frequently a slightly higher machine and broach cost will be negligible compared with lower tool and time costs per piece and greater precision obtained.

For *shorter* runs "how" you broach it becomes increasingly important. Here, Colonial engineers have frequently found it possible to cut broach costs way down by designing a simple broach which machines the part in several passes instead of one. True, output in pieces per hour may be less, but it is still so high compared to other methods that the saving is very large.

Are you missing a bet? Colonial engineers will be glad to give you their suggestions as to the most economical way to broach your job, and what it would cost, based on the widest broaching experience in Industry today.

DO YOU READ "BROACHING NEWS"? A note on your company letterhead will put you on the mailing list.

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DETROIT 13, U.S.A.
Broaches Broaching Machines - Broaching Equipment

Internal Measuring Instrument Graduated to Check 0.00005 Inch

An internal measuring instrument manufactured by The Sheffield Corporation, Dayton, Ohio, embodies both mechanical and electrical principles. This comparator-type instrument for the precision measuring of internal dimensions is equipped with an electric gaging head known as the Electrigage and an improved amplifying device (2,500 to 1) developed jointly by engineers of Sheffield and Westinghouse.

The electrical magnification causes instantaneous action of the indicator hand, thus giving a positive reading. There is no lag, and the stylus has a feather touch so that gaging pressure need never exceed three ounces. A fine adjustment knob is used in obtaining a zero setting. An automatic stabilizer prevents ordinary voltage variations from affecting accuracy of the readings.

The N-5 is normally used at the bench in receiving inspection, the toolroom, or gage laboratory for checking master and working ring gages, setting snap and length gages, for checking tools and other precision work having one or more internal dimensions. Precision blocks or masters are used as a reference in setting up the instrument. A limit-switch arrangement operating two red signal lights assists the operator in making the set-up and in properly positioning the work for checking.

Gaging range includes minimum and maximum gaging diameters of 0.370 in. and 12 in. respectively. The surface plate is adjustable vertically, giving a gaging from the surface plate to center of diamond points of 1/16 to 1½ in. depth of the hole. It is possible to explore a hole 3 in. deep throughout for diameter, taper, bellmouth, and out-of-round conditions. Capacity is sufficient to accommodate an A.G.D. ring of the largest size.

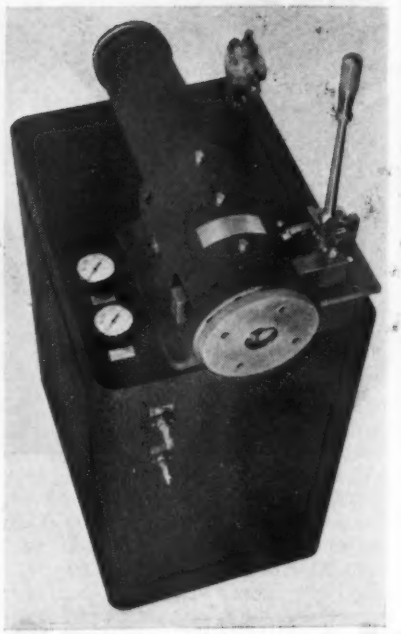
The instrument can also be supplied with special gaging arms for checking holes down to and including 0.240 in. dia. The maximum gaging depth from the surface plate to center of diamond points on these arms is one inch.

All critical and exposed parts are chrome plated for longer life. Tungsten carbide is used at points of contact to minimize wear. The linear scale is of the balanced type, having a total range of 0.0012 in. The distance between the smallest graduation representing 0.00005 in. is approximately ⅛ in. so that interpolation to 0.000025 in. or less can be accomplished.

Sheffield internal comparator

Double-Lap Flaring Machine Improves Flared Flange Tubes

A lap-flaring machine, intended for the production of a double thickness of metal on the flange of flared tubing, is manufactured by Leonard Precision Products, 1100 Larson Ave., Garden Grove, Calif. The purpose of a double thickness of flange metal on flared tube is to hold a greater working pressure and eliminate failure at connections.



Leonard Tube Master

No hand tools are required in the operation of the model DF Tube Master. To change size of dies the operator unscrews the faceplate and inserts proper die sizes. The tool bar slides out of the head for change of punches. While the machine is intended for non-ferrous tubing, sizes ⅛ to ½ in., special dies can be used to handle annealed ferrous tubing of ⅛ to ⅜ in. sizes. It is entirely pneumatic in operation and requires an average of 100 lb. air line pressure.

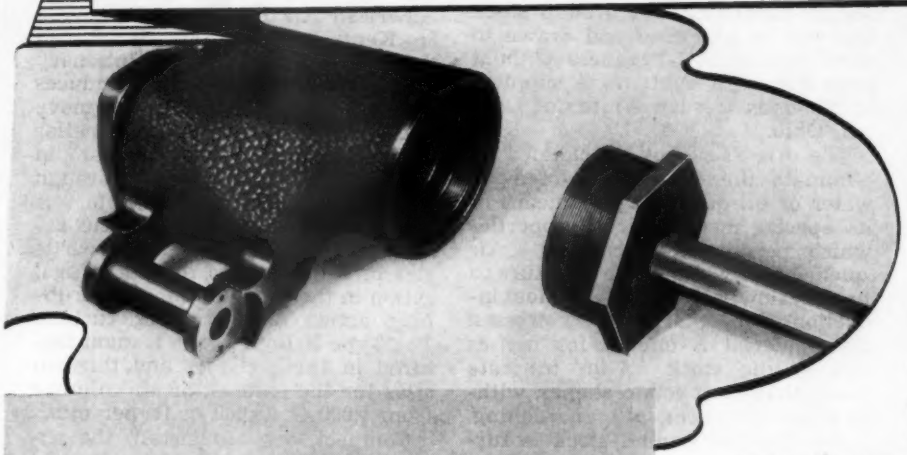
To produce double flares, the operating lever, which indexes to three positions, is first pressed to open dies for insertion of tubing; by moving the lever to the other two positions the flare is completed. The machine will produce 400 to 600 flares per min. A minimum of 2 in. of straight tubing is required to grip the tube in the die.

Paraffin Base Lubricant Prolongs Life of Drills

A paraffin wax base drill lubricant said to increase drill life by 25 percent is produced by the Aviation Lubricants Co., Box 1607, San Diego, Calif. The lubricant is a heavy material which looks much like shoe polish. It is packaged in cylindrical cardboard containers and is applied to the drill by running through the container. It is claimed to help eliminate hole elongation, decrease drill temperatures by 15 to 25 percent and prevent the drilled metal from welding to the point of the drill.

LIFE OF ONE STEEL THREAD PLUG GAGE
ONE 8 HOUR SHIFT

LIFE OF ONE LINCOLN PARK CARBOLOY THREAD PLUG GAGE
1½ YEARS PLUS!



Reported by

NASH-KELVINATOR CORPORATION

COLUMBUS • OHIO

"At the time these gages were bought, our steel gages were wearing between .001" and .002" in an 8-hour shift, meaning the job was shut down until a gage up to size was put on the job.

"The material these gages were used on was aluminum die casting with 13% silicon content.

"One of the Carboloy gages was put on the job 8-14-42, and wasn't turned to the back side until 10-18-43, having .0007" wear on it. This job was discontinued 3-1-44 and the gage read .0002" undersize.

"Although the gage was chipped, it still didn't interfere with the gage in checking the parts.

"From gage inspection, production and interchangeability of parts, we have had but minor troubles since we put Carboloy gages on all of our threading jobs."

To anyone familiar with gage costs, the tremendous increase in gage life through the use of Lincoln Park Carboloy gages certainly indicates exceptional economies.

But consider the example cited here . . . the inspection of binocular bodies . . . expensive parts produced to exacting specifications. Rejections of these parts, due to inaccurate inspection with steel gages made to include the customary allowances for wear, could show considerable loss of production time and money. Because Lincoln Park Carboloy gages—that showed wear of only .0007" in over a year—could be specified extremely close to required limits, unvarying accuracy in inspection was assured throughout the entire long life of the gages.

In specifying gages for volume inspection, consider *first* those that don't reject acceptable parts . . . and that have a useful inspection life at least fifty times that ever expected of ordinary gages. Consider *first* Lincoln Park Carboloy gages.

ARMY E NAVY

LINCOLN PARK INDUSTRIES, INC.

Successor to The Lincoln Park Tool and Gage Company and Carbur, Inc.

1721 FERRIS AVENUE • LINCOLN PARK 25, MICHIGAN

Master Diamond Checking Set Tests Rockwell Instruments

A master diamond checking set for checking the accuracy of hardness testing equipment is a product of Clark Instrument, Inc., 10200 Ford Rd., Dearborn, Mich., and can be used on all instruments used for Rockwell testing.

The set consists of a gold-plated diamond penetrator and two test

Clark checking set

blocks. The penetrator is carefully made to close tolerances to give the accurate measurements required for checking readings. Since it is designed to be used only for checking, it retains its original accuracy for a long period of time. When checking, the master diamond penetrator replaces the regular penetrator in the machine.

The same is true of the two master test blocks. Held to close limits, they are used only in connection with the master diamond. The resulting combination furnishes an accurate check of the machine, either as a periodical measure or whenever readings may be in doubt.

The Clark master diamond checking set is furnished ready for use in a fitted case.

Hard-Facing Metal Resists Abrasion, Impact and Heat

Fanweld, a non-ferrous hard-facing metal, is manufactured by the Fansteel Metallurgical Corporation, 2200 Sheridan Rd., North Chicago, Ill. The metal is intended for acetylene torch application to steel, and possesses marked resistance to abrasion, heat, impact and erosion.

Fanweld contains tantalum-columbium carbide which imparts a self-lubricating action, minimizing the destructive effects of friction even at elevated temperatures. Extensive tests indicate that it is unusually well suited for hot-work punches, dies and tools.

Properly applied, it "wets" steel surfaces readily without the use of flux, flowing smoothly and evenly. Surfaces as thin as 0.010 in. can be applied with a fusion layer as thin as 0.0005 in. No hardening or heat-treating operations are necessary. It is made in 3/16 and ¼ in. dia. rods in 14 in. lengths.

Air-Tru Air-Hardening Steel Heat-Treats Without Warping

An air-hardening, flat ground stock that can be hardened and drawn to 60-62 Rockwell C hardness without deformation of contours is supplied by Simonds Worden White Co., Dayton, Ohio.

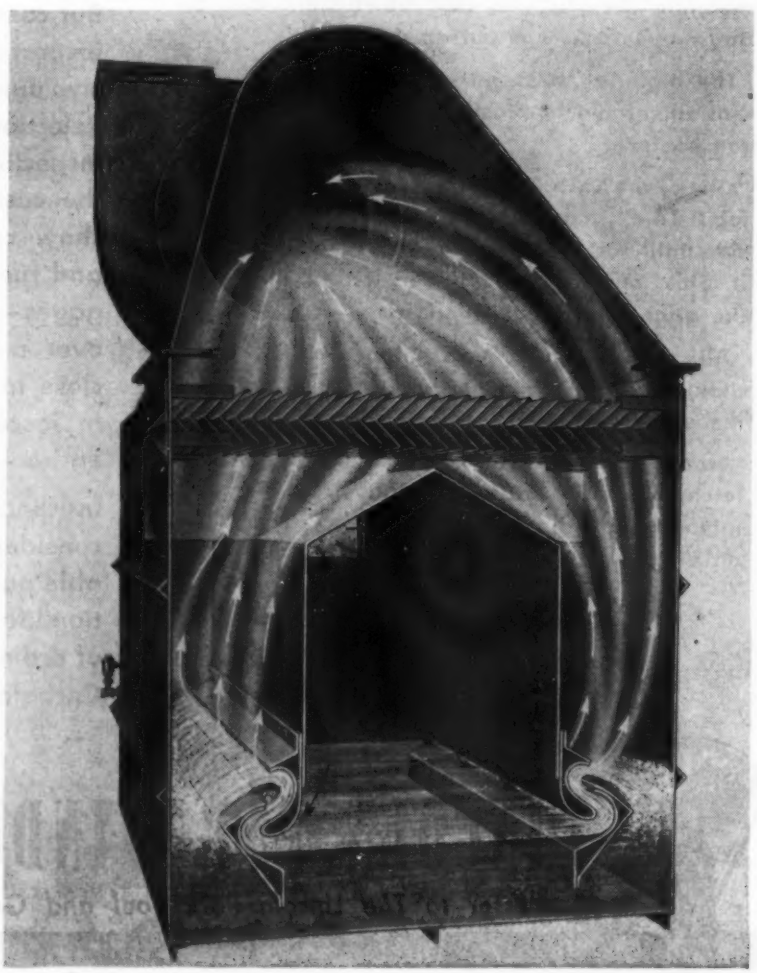
The Air-Tru alloy is claimed to eliminate the distortion caused by water or oil quenching by means of its special metallurgical properties which permit air quenching. Air quenchability allows the structure to harden slowly and evenly without induction of internal warping stresses. The material is offered for use as tool or die stock or for intricate forms that must retain shapes, within close tolerances, after hardening.

Air-Tru flat ground stock is furnished in rectangular pieces 18 in. long in widths from ¼ to 6 in. and thicknesses of 1/64 to 1 in.

Roto-Clone Precipitates Dust With Moving Water Curtain

The Type N Roto-Clone operates on the principle of hydrostatic precipitation of airborne particles without the use of moving parts. The air is cleaned by a combination of centrifugal forces and intimate intermixing of water and particle laden air. In the model designed by the American Air Filter Co., Louisville 8, Kentucky, the air is forced through the passages of a stationary submerged impeller. This induces a heavy sheet of water to move along the surfaces of the impeller blades, creating a water curtain in the form of a reverse S through which the air must penetrate. A high collection efficiency is the result of the impingement of the particles in water due to the centrifugal action in the impeller and the scrubbing action of the water curtain. The Type N Roto-Clone is manufactured in three classes and thirteen sizes for the exhaust of air columns from 1,000 to 25,000 cu.ft. per min.

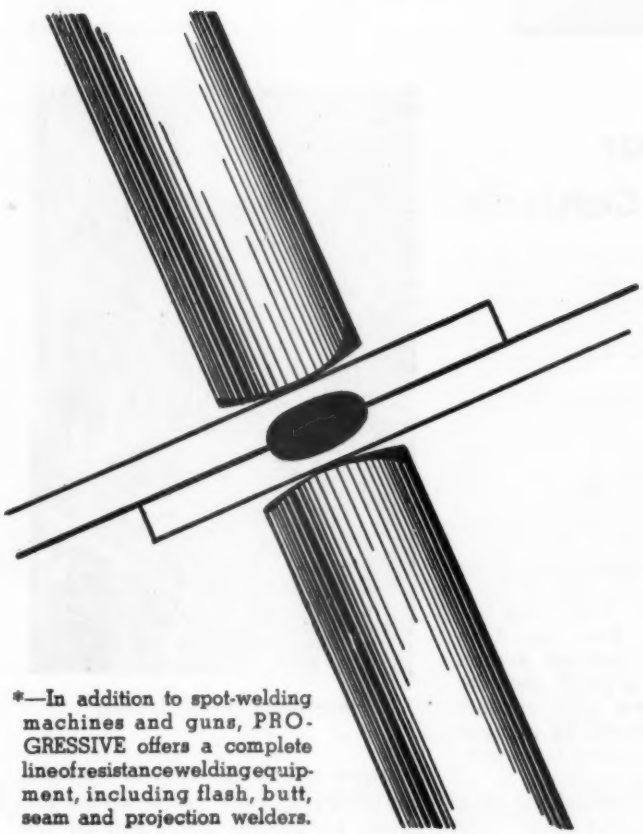
Compact, easy to install, the absence of moving parts makes it ideal for the safe control of magnesium and explosive dusts.



Roto-Clone dust collector

The simplest fastening device

is a SPOT WELD



*—In addition to spot-welding machines and guns, PROGRESSIVE offers a complete line of resistance welding equipment, including flash, butt, seam and projection welders.

Whenever you have to provide, in production, for fastening two or more pieces of metal together it pays to remember that the quickest, simplest and lowest cost method is to spot-weld them.

No "extra" parts are needed as with bolts and nuts, rivets, clamps of all kinds, etc. There are no holes to drill or punch, ream or tap, or align.

With PROGRESSIVE equipment, moreover, you can spot-weld* metals (aluminum and other non-ferrous metals, plain, stainless and other alloy steels, etc.) in thicknesses from thin sheets to heavy structural sections.

PROGRESSIVE field engineers, backed by a greatly expanded staff of design and application engineers selected from the resistance welding industry on the basis of their experience and Success are ready to assist you in "designing for welding".

We will also be glad to send you a copy of "RESISTANCE WELDING AT WORK", containing some 100 examples of typical resistance welding applications.

Ask for Booklet #WP-44 on your company letterhead.

PROGRESSIVE WELDER CO.

SEAM PROJECTION & BUTT . . . *Electric Welding Equipment* . . . PORTABLE GUN & PEDESTAL

3050 E. OUTER DRIVE • DETROIT 12, U. S. A.

Standard welding positioner

Powered Welding Positioner for Heavy Work Has Simple Controls

A powered welding positioner is manufactured by the Standard Machinery Company, Providence Rhode Island, for rotating work up to 700 lb. at speeds from 0 to 2.4 r.p.m. in either direction by handwheel control. The unit will accommodate table speeds up to 180 in. per min. with a work radius of 1 ft. Linear speeds at all radii are set and indicated on scale located on the side of the frame.

To obtain a desired welding speed it is necessary for the operator to note the approximate radius at which the welding is to be done and to move the control wheel until the indicator is opposite the desired welding speed in the scale column for that radius. For sequence or step welding the table can be positively started, stopped or reversed.

The machine is adaptable for moving work past the torch and quench in flame-hardening operations. The table can be removed and various jigs attached directly to the spindle. Also, the work mounted on the positioner table can be tilted to any angle, permitting the worker to operate at one position and so facilitate the inspection of parts or assembly operations.

While the table is originally designed for use as a support for parts to be welded and is only 28 in. in dia. it may be utilized as a basis of power in moving fixtures and work across machine tool tables in sequence operations.

The positioner is provided with a built-in variable speed transmission and hydraulic cylinder for power control with a single ½ hp., 110-, 220- or 550-volt motor. There are no belts or clutches. Instantaneous starting, stopping and reversing is provided by a foot-operated switch controlling the driving motor.

Height of the table is adjusted between 30 and 36 in. from the floor by means of its elevating screw. Hand operation of a latch permits rotation of the screw with respect to its supporting sleeve, in a manner similar to the raising or lowering of a piano stool.

The table is tilted by means of a hydraulic cylinder and gear segments. The oil pressure is developed by utilizing the gears that synchronize the disk-drive rolls of the transmission. When not required for tilting, oil from the pump flows continuously at reduced pressure to lubricate and cool the drive-roll-shaft, anti-friction bearings.

Tilting of the table through 135 deg. from the horizontal is controlled by a spring-centered handle which the operator moves through an angle of approximately 45 deg. in the direction of the desired table movement. Automatic limit stops are provided.

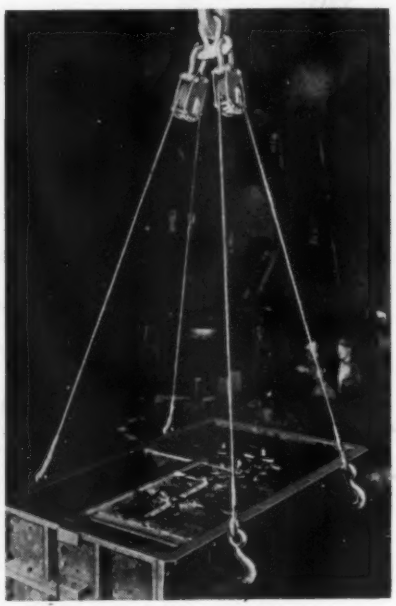
The mechanism of the machine is enclosed entirely for safe operation. There are no exposed gears. All moving parts are protected against splash from molten weld rods.

Positioner is 39½ in. long, 19 in. wide and weighs 665 lb. The table is 28 in. dia., ⅝ in. thick and rotates on an elevating screw of 2 in. diameter.

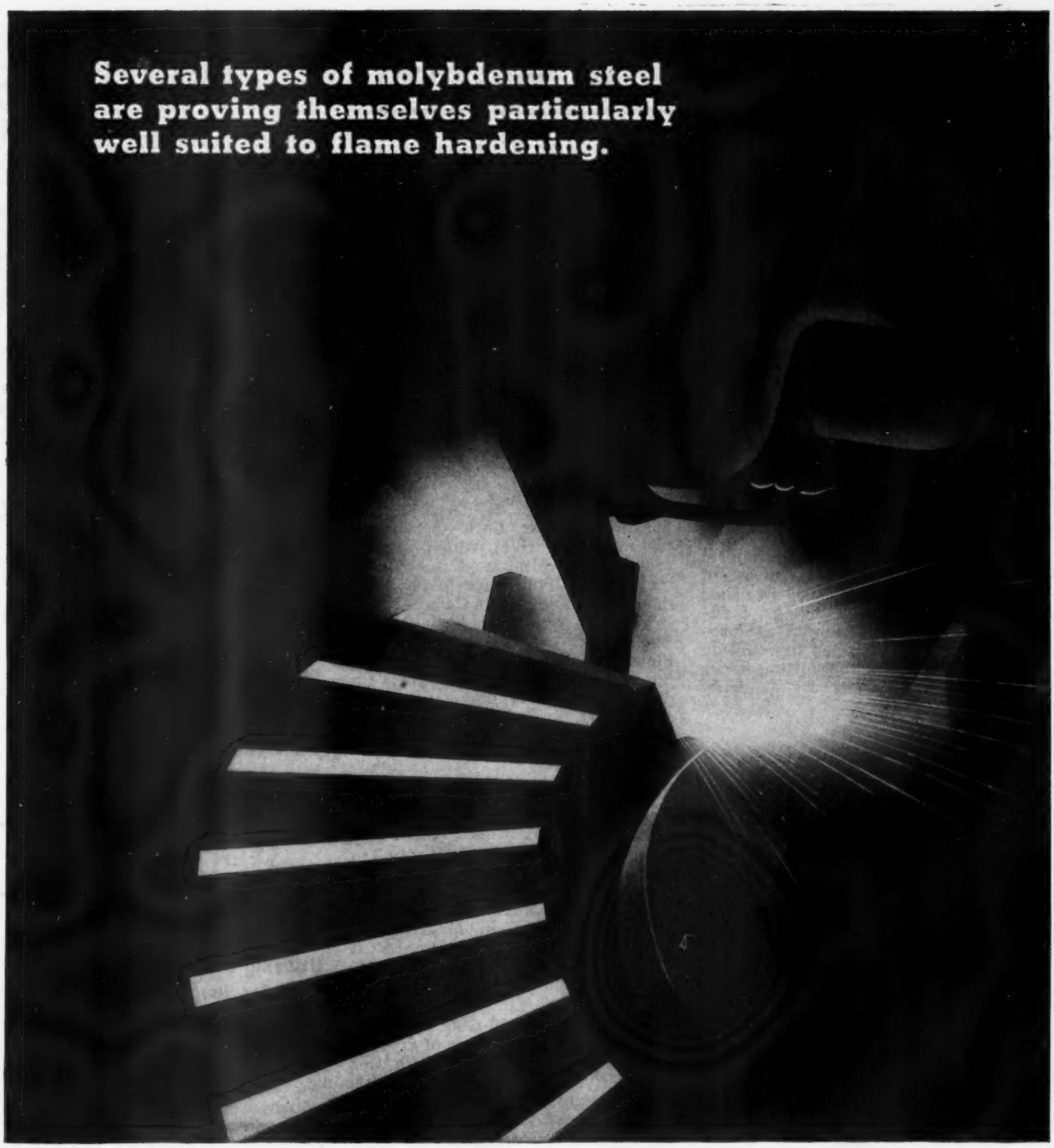
Level-Lift Sling Adjusts To Balance Uneven Loads

The Level-Lift sling, formerly made in 3 and 6 ton capacities, is manufactured by the Macwhyte Company, Kenosha, Wisconsin, in ¾ and 1½ ton capacities. The sling permits adjustment of sling leg lengths automatically to balance a lifted load.

After the lightweight block containing wire rope is put on the crane hook, the crane operator spots the crane hook over the approximate center of gravity of the load and the floormen attach the sling to the load. The crane operator then applies the power to lift the load, and as the crane hook is lifted, the rope automatically adjusts itself through the "Level-Lift" block. In so doing, one sling leg of rope becomes longer than the other, and as the weight of the load pulls on the wire rope, the sheave in the block pulls down against a brake which prevents slip-



Macwhyte Level-Lift sling



CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

ARMY E NAVY

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Climax Molybdenum Company

500 Fifth Ave. • New York City

MOLY

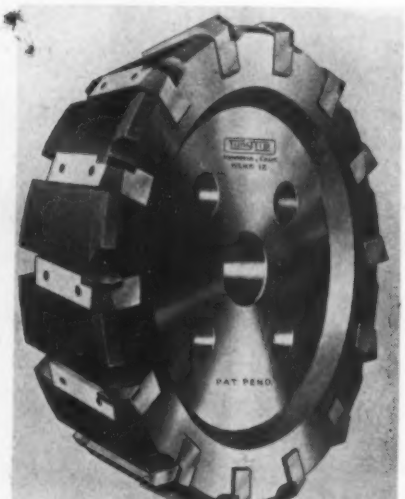
page. The load is then lifted level.

If the block and crane hook are away from the load's center of gravity, the operator need only lower the load enough to relieve tension on the sling which releases the brake and then move the crane hook over to the true center of gravity. On applying the power, the ropes readjust themselves and the load rises level.

Milling Cutter Tooth Inserts Adjust; Eliminate Rough Grind

The Tungtip inserted tooth milling cutter, manufactured by Tungtip Tool Div. of Lowell & Grayson, Monrovia, Calif., consists of carbide-tipped teeth rigidly locked into the tool body. These carbide-tipped tool steel inserts are provided with a precision flat back and serrated front face, which assures uniform clamping pressure over the entire length of the insert.

An adjusting screw mechanism provides for precise adjustment of the insert to within 0.003 in., thus eliminating rough grinding of inserts. Replacement inserts are provided with the face of the carbide finish ground and the cutting edges rough ground. They are available



Tungtip inserted tooth cutter

in face mill and half-side mill styles. The alloy steel body of the face mill is counterbored in the back of the cutter providing a ground surface for location on the outside of the spindle nose of the milling machine. Half-side mills are provided with a ground arbor hole and hub faces for accurate alignment for straddle milling operations. Both types of cutters are available with carbide teeth ground with corner angle or may be had with inserts ground to 90 deg. corner for milling to a shoulder.

TRADE PUBLICATIONS

Buyers' Guide—Lists buyers and agents for Latin America by classification, includes maps and charts. Descriptive folder on request. American Foreign Credit Underwriters Corp., 170 Broadway, New York 7, N. Y.

Burners—Bulletin No. 416 has data on oil burners. W. S. Rockwell Co., 50 Church St., New York 7, N. Y.

Centerless Grinding — Workrest blades hard surfaced for better wear resistant qualities. Folder gives dimensions for many types. Scully Hard-Surfacing Division, Scully-Jones & Co., 1900 S. Rockwell St., Chicago 8, Ill.

Fastener, Spring Lock—A self-adjusting, blind rivet which can be removed readily; used for sheet-metal parts. Four page folder. Simmons Machine Tool Corp., North Broadway, Albany, N. Y.

Floor Machines—Folders describe power-driven brushing machines for dry cleaning dirty floors to remove chips, dirt, grease. G. H. Tennant Co., 2530 Second St., North, Minneapolis 11, Minn.

Gears—A 16-page illustrated bulletin about crossed-axis gear shaving machines. National Broach & Machine Co., 5600 St. Jean Ave., Detroit 7, Mich.

Hardening—Booklet "Fifty Facts" shows experience in heat-treating steels. Perfection Tool & Metal Heat Treating Co., 1740 W. Hubbard St., Chicago 22, Ill.

Jig, Cone-Lok—A 16-page book lists dimensions of three types of drill jig assemblies. N. A. Woodworth Co., Sales Division, 1300 E. Nine Mile Road, Detroit 20, Mich.

Machine Tools, Rebuilt—An illustrated booklet shows the plant and methods for restoring machine tools to active service. J. L. Lucas & Son, Bridgeport, Conn.

Ovens—Catalog No. 114. Baking, curing and drying ovens, description and layouts. Gehnrich Oven Division, W. S. Rockwell Co., 108 Jewell St., Brooklyn 22, N. Y.

Screws, Wood and Machine—Of interest to those who purchase or specify various types of brass or steel, wood or machine screws, is the new list; the arrangement is convenient for quick reference. American Screw Co., Providence, R. I.

Space Heaters—Aircraft and automotive heaters with capacities from 15,000 to 100,000 B.t.u. per hr., burn kerosene or high octane gasoline: for warming-up engines, heating buildings. Form SH-2, Fluid Heat Division, Anchor Post Fence Co., 6500 Eastern Ave., Baltimore 24, Md.

Steel—Leaflet shows performance of HWD and Cromovan steels. HWD is a hot work die steel for forming, forging and die casting under severe pressure or impact; Bulletin SL-2014. Cromovan has improved machinability, high abrasion resistance, unusual depth of hardness (preventing sinking), and minimum dimensional change during hardening; used for cutting and forming dies; Bulletin SL-2022. Firth Sterling Steel Co., McKeesport, Pa.

Supplies—800-page catalog of industrial, contracting, and mining supplies. Colonial Supply Co., 217 Water St., Pittsburgh 22, Pa.

Tools—Catalog of precision tools for aircraft and manufacturing industries. Zephyr Manufacturing Co., 201 Hindry Ave., Inglewood, Calif.

Welding Machines, Resistance—Tables give capacity, and diagrams show dimensions and arrangements of machines to make pressure-tight joints. Bulletin 113-A, Sciaky Bros., 4915 W. 67th St., Chicago, Ill.

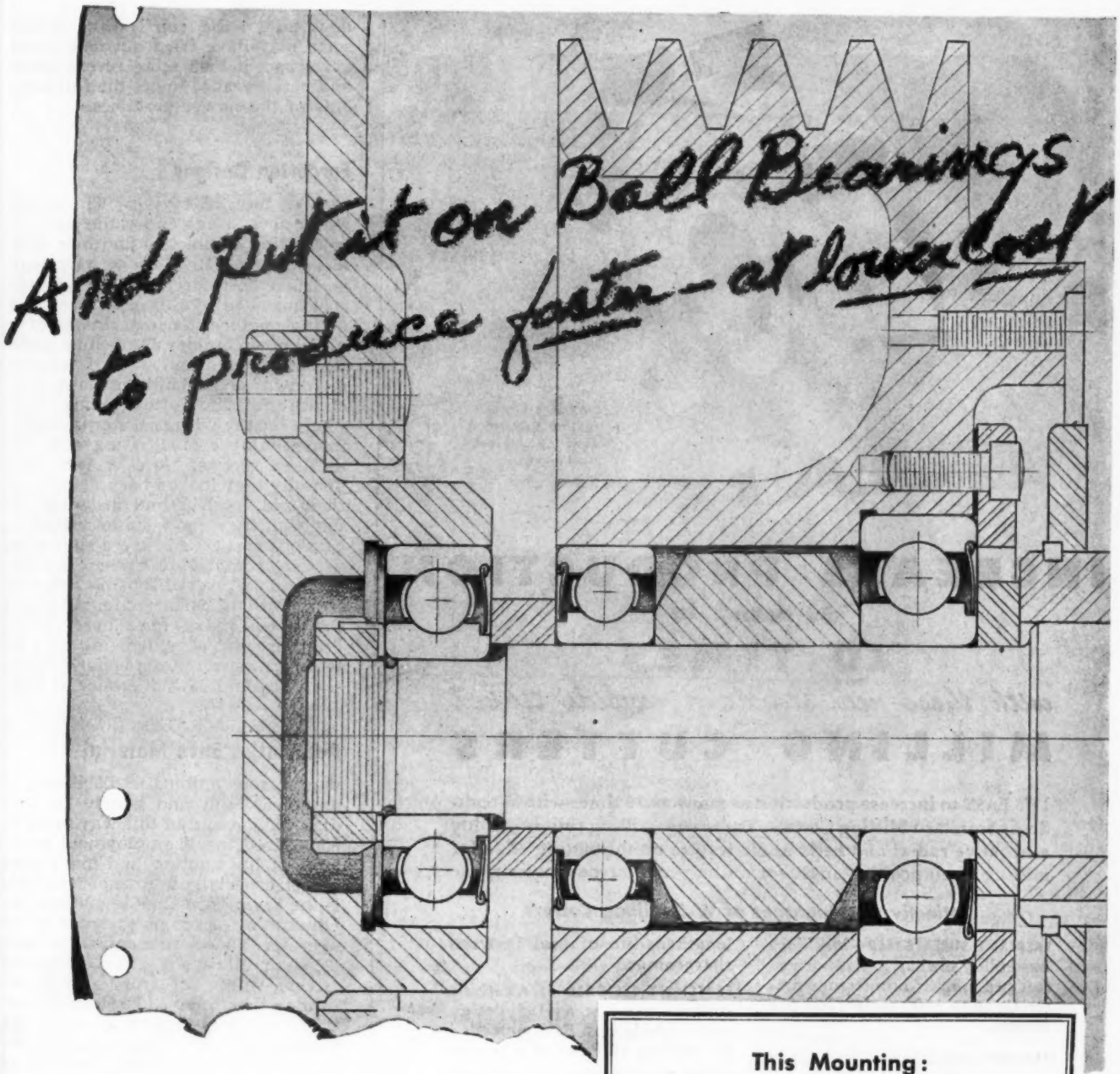
SEEN and HEARD

By JOHN R. GODFREY

Utilizing Old Ideas

WITH ALL the new developments in machine practice, and there are plenty, it is interesting to find that similar methods were used more years ago than seems possible. Since we began to talk of "climb" milling, which was practiced by some long before its advantages were generally recognized, instances of its use long ago continue to crop up. I've seen copies of a milling machine catalog dated 1900 that mentions the compensating nut on the feed screw to prevent backlash. The same maker said he used this method in 1872.

Now comes a friend who was working for Brown & Sharpe in 1895 on a job of milling brass tubing. They used the regular method of feeding "against" the cut, or what we now call "up" or "out" milling. They had a lot of cutter breakage until the boss tried milling with the cutter running the other way, now called "climb," or "in" milling. This cured the cutter breakage and did a better job. But there's no use trying to spring the old gag about "nothing



WHEN the war is won, ball bearings will help to bring sound, simplified design and lower maintenance expense to countless new machines of every kind.

And on the production lines, ball bearing equipped machines will produce faster, better and at lower cost for the peace needs of industry, even as they are now setting world records in quantity and quality of goods for war.

This is one of a series of bearing mounting designs. Others of the series will be sent upon request.

This Mounting:

Ball bearing designs need not be complicated to be efficient or capable of long service with little attention.

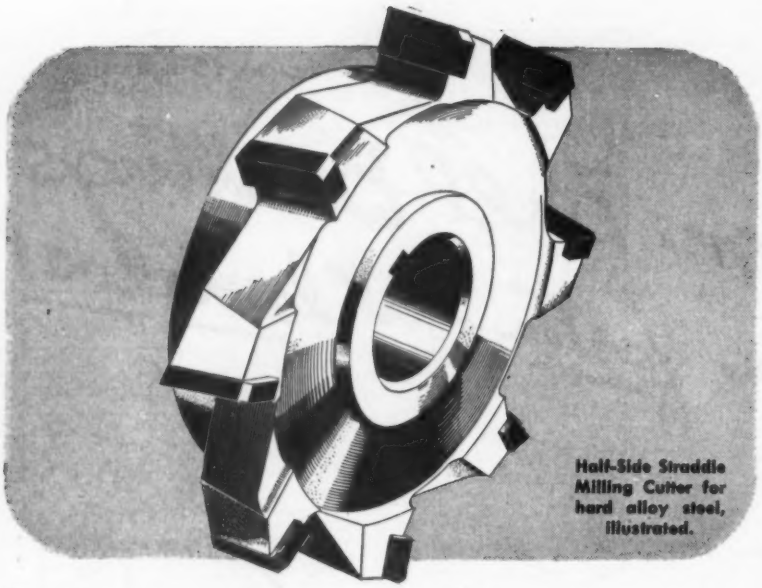
This Lathe Pulley mounting merely follows the simple fundamentals of ball bearing application, yet it assures trouble-free operation at any speeds at which the machine can be run. And, maintenance is just about zero.

Note: 1. Machining for pulley bearings is all from one side. 2. Spacer between bearings leaves room for only such grease as will actively lubricate. No waste. 3. It is shaped to keep grease in good condition and in the bearings. 4. Narrow spacers at ends of pulley extend well beyond shield notches in bearings—give more efficient closures.

NEW DEPARTURE
BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS CORPORATION • BRISTOL, CONNECTICUT

Sales Branches: DETROIT, G. M. Bldg., *Trinity 2-4700* • CHICAGO, 230 N. Michigan Ave., *State 5454* • LOS ANGELES, 5035 Gifford Ave., *Kimball 7161*



INCREASE PRODUCTION

as many as

10 TIMES

with these new standard carbide tipped

MILLING CUTTERS

IT'S EASY to increase production as many as 10 times with Wendt-Sonis Standard Milling Cutters. These new milling cutters employ a negative radial and helix angle feature on the cutting edge for milling steel; positive angle for milling non-ferrous materials.

Distinctive Advantages of W-S Milling Cutters

INCREASED SURFACE FEED—Machines hard alloy steel up to 750 surface feet per minute; non-ferrous materials up to 3400 surface feet per minute.

PREVENTS VIBRATION—The built-in heavy lug fly-wheel prevents vibration, adds strength to cutters; lengthens life of tool between sharpenings.

ESPECIALLY DESIGNED—for carbide cutting—not just a HSS design with carbide tips. Recommended for milling all types of material.

EASILY RESHARPENED—on any universal tool and cutter grinder.

Carbide Tipped Tools are a specialty with us. We make them exclusively. Our experience, research, development and improvements are your assurance of complete satisfaction when you use W-S Carbide Tipped Tools. Refer to "TOOLS" in your Classified Telephone Directory, for your local W-S Distributor, or write WENDT-SONIS COMPANY, HANNIBAL, MISSOURI. Branch Warehouse: LONG BEACH, CALIFORNIA.

Free!

New! CATALOG 144. Contains data and latest prices on W-S Standard Milling Cutters plus many other standardized carbide-tipped tools formerly classed as "special." WRITE TODAY for FREE copy.

WENDT SONIS

CARBIDE TIPPED CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • ROUTER BITS • SPECIAL TOOLS

new under the sun." For while some may have tried out new ways years ago, it took more recent ideas and perseverance to get the full benefits of the newer practices.

Forgotten Designs

DESPITE the old saying, "There are many new things under the sun," it is startling at times to find how new ideas really date back a long way and have been forgotten. A fairly recent instance of this kind occurred in the engineering department of a well-known builder of machine tools. Realizing the trend toward "climb" or "down" or "in" milling (take your choice but the latter seems most likely to stay with us) they got busy in designing compensating nuts for all feed screws. More or less accidentally they looked back at some of their old catalogs and drawings, to find that they had been described in catalogs of 1900 and were shown on drawings dated 1910. These drawings incidentally, were probably redrawn from those of earlier date, but given the date of redrawing. There are indications that compensating nuts on feed screws were used as far back as the Philadelphia Centennial in 1876.

Automatics Save Material

WHILE MOST automatic machinery is designed, built and bought to save direct labor, and in this way must be considered in all employment problems, it has another and more vital object, especially in time of war. This is the saving of valuable material by eliminating errors on the part of the operator. There are many parts, such as the crankcase of a large airplane engine, where an error, even in one of the earlier operations, can be costly in material. Errors as the work progresses become increasingly costly and toward the end the cost of scrapping a piece becomes exceedingly so. For at this point the loss includes not only the valuable material, but all the labor cost that has gone into it. In addition, delays affect the movement of much-needed material to the fighting fronts. In this way, new types of automatic machines now coming into use may play a real part in shortening the war.

There's a Limit to Automaticity

THE TREND toward more automaticity in machine control continues along different lines. The electric-eye and its many modifications is bound to become more and more a part of machine operation. Applied to increasing the safety of punch press and similar operations, it promises to be a great conserver of time, material and human fingers. Clumsy safety gates may go into the discard with the coming of the

HE *Doesn't know* WHERE HE IS!

He doesn't know where he is—and he doesn't care. He was given just a job to do. "Run so many pieces" the boss said—"We'll check 'em later!" So the operator went to work—in the dark—without knowing "where he was." What if something did get out of adjustment or the tools wear faster than they were supposed to. He should worry—the bad parts wouldn't show up till the job was done.

But suppose the boss had said, "Joe, run so many of this. It's got to be a good job—hold it close. And here's a gage to show you where you are. Check every piece. If anything gets out'a line, call me—*don't run scrap!*"

Here was a real job—a responsibility. It was up to Joe to make GOOD parts —and not make any scrap. The job was tough—he had to hold it close. But Joe did it—and he was proud of it. He knew "where he was" because he checked each part right at the machine with his Sheffield indicating gage. The gage told him whether the machine was going out of adjustment—when the tools were getting dull—and if he was doing anything wrong.

If your jobs are tough—and scrap is piling up—because your operators are "working in the dark", CHEK WITH SHEFFIELD.

Write for Engineering Data or a demonstration in your plant of Sheffield Visual Gages • Precisionaires • Airsnaps • Electrigages • Dial Indicator Snaps and Thread Checking Instruments. **"THERE'S A SHEFFIELD INSTRUMENT FOR EVERY GAGING APPLICATION."**

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Cut Sawing Costs

with CAPEWELL

Hack Saw Blades

The long life of Capewell hack saw blades brings you two-fold savings: *First*, greater economy in blades; *Second*, fewer set-ups. Expressed in other terms, this means lower cost per piece sawed. Month after month these advertisements have been telling you of economy records established by Capewell hack saw blades. Perhaps such savings are also possible in your plant. Investigate these tough blades that lick the hard jobs. Just ask your mill supply man about giving Capewell hack saw blades a trial.

THE CAPEWELL MANUFACTURING CO.
Hartford, 2, Conn.

CAPEWELL
HACK SAW BLADES

THE CAPEWELL MFG. CO.
Hartford, 2, Conn.

electric eye, and this is only one application.

Automatic controls, such as the new one announced by Bullard, promises to affect more types of machines than have previously been considered adapted to automaticity. This device can, apparently, be applied to milling machines, lathes and jig borers, turning them into automatic machines except for putting the work in and removing it. Aside from the time saved and the reduced skill required by the operation, spoilage should be almost unknown.

But even the adaptability of this control to many machines will not put it in the shop where parts are made in small quantities. We shall still need skilled mechanics in job shops and machine maintenance.

Hardening by Repeated Draws Lengthens Tool Life

By FRANCIS A. SPENCER
General Railway Signal Company

THE VALUE of drawing high-speed steel sufficiently to give it a shock-resisting structure has been demonstrated by many tests which have been made in an effort to gain extra life of high-speed tools. It has been general practice in the past not to allow high-speed steel its full hardness because of the possibility of creating brittleness. While there were few cases where such steel was given more than one draw at the beginning of the war, two draws are now commonplace. The value of redrawing has been realized to the extent that all steel used in this plant is given at least three draws, sometimes as many as five and in one instance seven were given.

We recently received a shipment of molybdenum thread chasers which were not extra hard, but all broke up on a comparatively few cuts. We took six sets and gave them two draws in a salt bath for two hours each, at 1025 F. Five of the six sets ran from 150 to 295 shells before grinding was necessary. One set still showed signs of brittleness and chipped on ten shells. It was reground and drawn again at the same temperature and time, and put back into the machine and ran 93 parts when it was found to be in excellent condition. The material being cut was WDSS3 steel, Carbon 0.56, Manganese 1.00, Silicon 0.35, Phosphorous 0.055, Sulphur 0.06, Chromium 0.30, Nickel 0.35.

The life of a circular boring tool of molybdenum high-speed steel, operating on aluminum, was increased from 3,000 to 5,000 parts by one more draw at 1025 F. for two hours. This tool had been given two draws previously.

Two circular form tools were chosen at random from stock. One

No. 990 "YANKEE" VISE

No. 1545
"YANKEE" RATCHET
HAND DRILL

BETTER TOOLS . . . BETTER PRODUCTION

It's as simple as that. And it explains, more than anything else, America's proud record of production for war. "Yankee" Tools have been in the thick of this national production . . . turning screws, boring holes, gripping metals at the bench . . . doing what good tools are supposed to do, and what the ingenuity of "Yankee" Tools does faster, easier, and better. When the war is over, every workman who wants "Yankee" Tools can have them. We're working toward that day with everything we've got. In the meantime, take care of your present "Yankee" Tools. They've got what it takes to save time, labor, and money on countless jobs.

Order from your industrial supply distributor, or write North Bros. Mfg. Co., Dept. AM-445, Phila., Pa.

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A Size for Every Purpose

"YANKEE" TOOLS
make good mechanics better
North Bros. Mfg. Co., Phila. 33, U. S. A.
Established 1880

Makers, also, of "Yankee-Handyman" Tools

was made of 18-4-2-9, which is a high cobalt steel and the other of molybdenum 5.5-4-2 steel stock. They were hardened in our own plant although both had been drawn twice previously and each Rockwelled C64. Three extra draws brought them to cobalt type 66C and molybdenum type 67C. These tools were giving a maximum of 136 pieces per grind and were used for cutting a band groove in 105 mm. shells of the WDSS3 steel. After the additional draws the cobalt tool gave a maximum of 356 pieces per grind until used up and the molybdenum gave 620 pieces until used up. These tools were used with a good flow of cutting oil.

We find it necessary many times to run small tops and center drills through one or more draws, as well as large 1 35/64 in. twist drills which were chipping and giving very low production, but which gave good results after two more draws in a salt bath.

Hammer tests generally have shown much greater impact value after additional draws, even though the Rockwell hardness has been raised as much as three points.

Welded Ships Stand Severe Tests at Sea

PERHAPS THE GREATEST TEST to which welding has been subjected since it has been adapted as an improvement over riveting was its use in building merchant ships during the war. The effectiveness of welding of ships has thus not only been subjected to severe stress and strain of heavy seas, but it has also withstood torpedoes, air bombing, fires, collisions, and even enemy shell-fire.

In evaluating welded ships, Admiral Emory S. Land, chairman of the Maritime Commission said: "On combat damage, comparing welded Liberty ships and others, everything is in favor of the Liberty ships. A lot of them have broken into sections due to combat damage; in Liberty ships, the percentage is entirely in their favor because riveted ships are apt to go to the bottom when they are bombed or mined or torpedoed. It is truly remarkable the salvage we have obtained from these Liberty ships in combat damage."

Admiral Land recounted the incident of the *Anne Hutchinson*, the Liberty ship which was torpedoed twice and refused to sink. "When the first torpedo struck the number four cargo hold, the explosion almost lifted the ship out of the water. It severed the line shaft and practically tore out the ship's bottom. The vessel broke in half and it was only after being buffeted by storms that the after part sank. The bulkhead of the engine room held and the forward part of the

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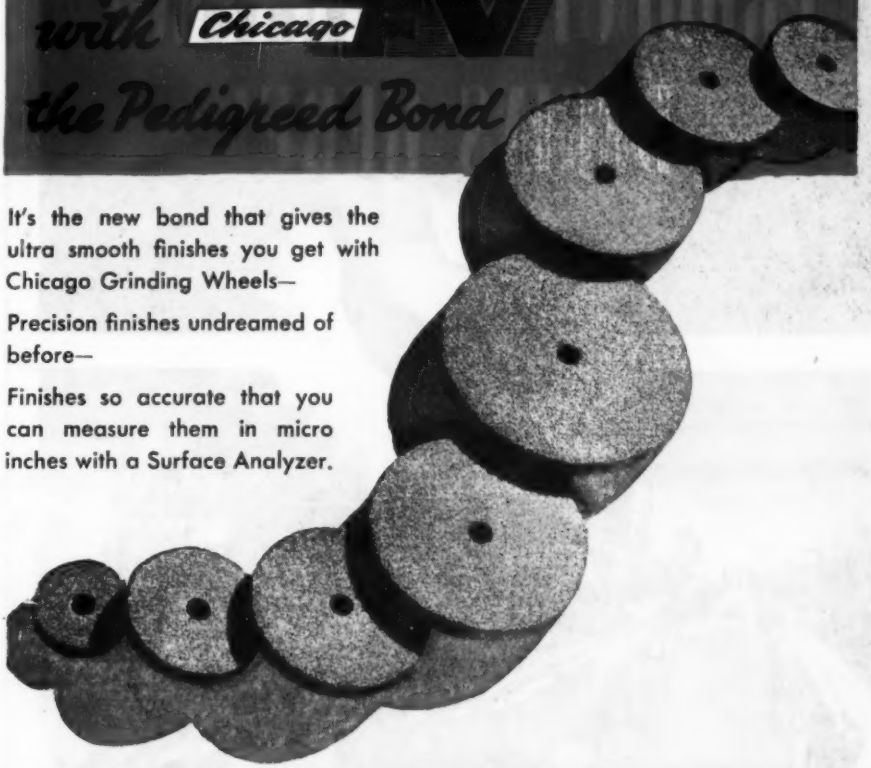

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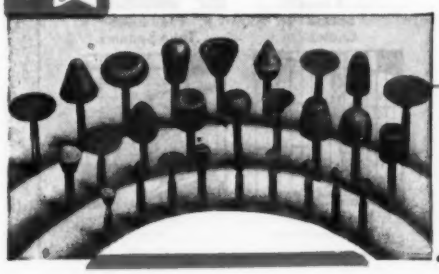

Write for Catalog listing all Chicago products and showing comparative photographs of finishes with different kinds of Wheels.

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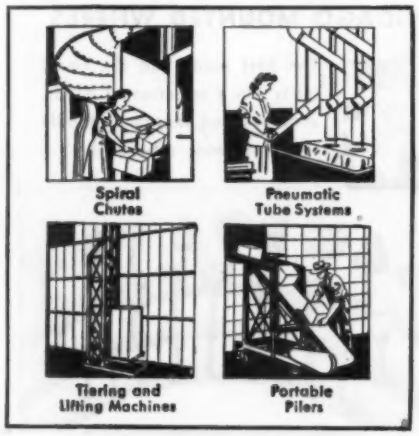


vessel remained afloat. Later the second torpedo struck in the starboard engine room in the way of the boiler. This explosion completely destroyed the starboard boiler and shifted the main engine from its foundation ten feet to port. Still the vessel would not go down, she remained in an upright position and was towed to port."

In a report by the Sun Oil Company, operators of the motorship *Pennsylvania Sun*, an all welded tanker, told how this vessel was torpedoed at the midship house on the port side and the explosion tore away the side shell plating, one wing bulkhead and pierced the other wing bulkhead, opening approximately seven of the cargo tanks to the sea. Yet, after the fire was put out and temporary repairs were made, the ship proceeded under its own power into drydock.

One reason why damaged ships have remained afloat is that welded construction uses less steel, resulting in ships of lighter weight. Moreover, the welds resisted the shocks of explosion far better than a riveted ship would.

Welded ships have been produced at the rate of 2,158 hulls in about 40 months. The WPB recently stated that welding "saves 845,000 rivets and 1,790,000 rivet holes."

Drill Makers Salvage Steel In Broken Tools

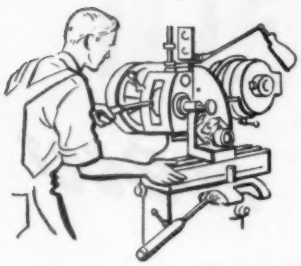
BY W. O. DOWNS

AN APPRECIABLE cash return can be gained by segregating broken high-speed tools and returning them to their original manufacturer. He is able to separate the reamers and drill from their brazed steel shanks, by just the opposite method by which he put them together. The manufacturer keeps the soft steel or shank portion for his trouble and, for the balance, allows the market value of high speed steel scrap.

The price allowed for scrap is always based on the classification of the lowest priced commodity in the lot. Thrown in with steel scrap, a thousand pounds of broken high-speed tools would bring one cent a pound, or $10. However, if they were sent to their original manufacturer, approximately $150 would be realized.

Separation of reamers and drills from their shanks, by other than the original manufacturer, is not likely to be wholly successful, in that a small piece of the high-speed steel would remain in the shank. This might result in rejection of the lot by a purchaser, or in failure of a manufactured article made from the shanks scrap.

"YOU CAN GET AT THE WORK"



"RIG IT UP QUICKLY"

"SO EASY TO OPERATE"

Why Operators Like the Nichols Hand Miller

OPERATORS have their favorites among machine tools. Listen in on their shop talk and you'll hear the Nichols Hand Miller rated "tops"...easy to operate...a producer of close work in volume...and so carefully built that maintenance delays are rare.

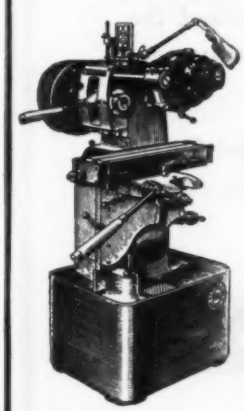
Nichols Miller operators like the way "you can get at the work," with the rise-and-fall spindle always directly in front of them. And they can move the counter-balanced sliding head up or down with little effort to any position to bring the cutter to the work or vice-versa. All other controls are also within easy range.

The rise-and-fall principle makes possible the use of simple fixtures, so that even the semi-skilled can load without delay, then change over the machine from one job to the next in rapid sequence.

Rigid, compact construction makes the Nichols Miller the handy machine to have around for dozens of milling, turning, boring and facing operations where tolerances in "tenths" are required. It often does the work of costlier millers, lathes, boring machines or grinders.

Considered the least expensive "foundation" machine ever built, the Nichols Miller quickly pays for itself in low-cost operation and negligible maintenance. It will make a profitable addition to your production line or toolroom. Investigate its many advantages today. Start by writing for our new illustrated brochure.

"THE MILLER THAT USES ITS HEAD"



THE NICHOLS MILLER

MANUFACTURED BY W. H. NICHOLS & SONS, WALTHAM, MASSACHUSETTS

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Sinclair OPALINE RP (Rust Preventing) OILS for enclosed oil systems, prevent internal rusting of engines, hydraulic systems, gear reducers, and similar machinery intermittently operated, stored, or transported. OPALINE RP also has ample lubricating qualities for temporary use.

Both these remarkable Sinclair rust-preventives have successfully passed the most exacting service tests, and fully meet Government specifications.

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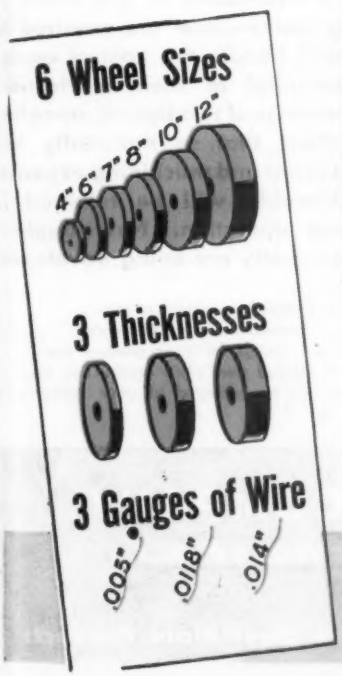

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That's because crimped wire gives Whirlwind Brushes extra *life* and *spring* . . . assures correct clearance between wires . . . holds the brush in an even, compact mass. *And each separate tuft of wire is securely locked in a ring of steel!* Whirlwind Brushes now are available in six sizes, three thicknesses and three gauges of wire . . . for use on almost any grinding, buffing or polishing machine and on all Black & Decker Portable Grinders, Bench Grinders and Sanders.

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You will find the long and varied experience of our engineering staff an invaluable aid in determining whether parts and fittings for your product are adaptable to welded steel plate construction. Consultation can be arranged at your convenience.

This Gear Case section exemplifies one of the many new uses to which Mahon welded steel plate work is being applied.

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Here is proof of the adaptability of Auto-Lite die castings to the most exacting instrument construction. In the case of the Oxygen Regulator limits of one ten-thousandths of an inch are secured in final finish. "Controlled Metals" result from such practices as spectrographic analysis, metallographic studies, physical testing, x-ray inspection and heat treating. Write us about your problem today.

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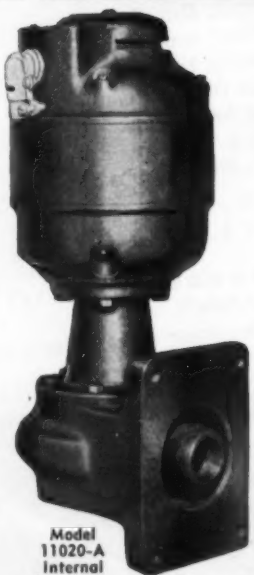
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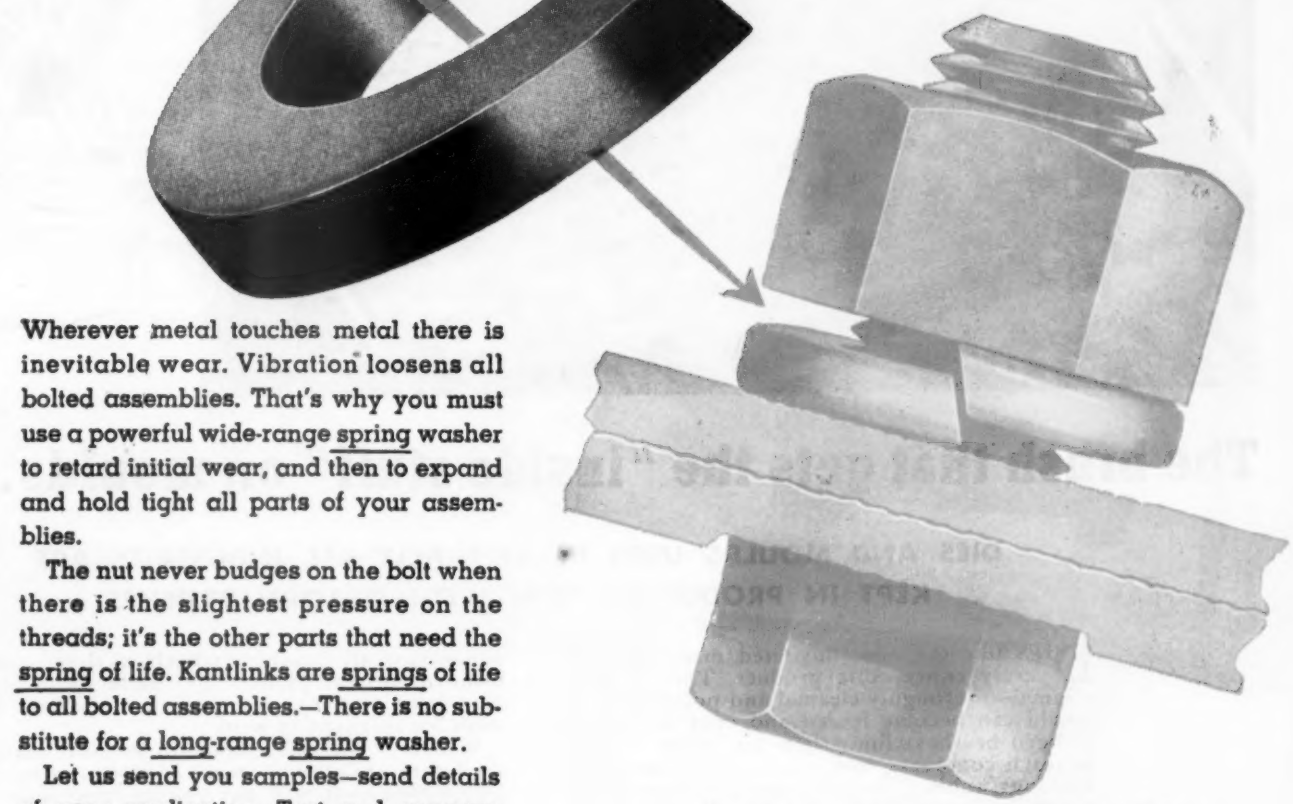
FOR ALL BOLTED ASSEMBLIES



Wherever metal touches metal there is inevitable wear. Vibration loosens all bolted assemblies. That's why you must use a powerful wide-range spring washer to retard initial wear, and then to expand and hold tight all parts of your assemblies.

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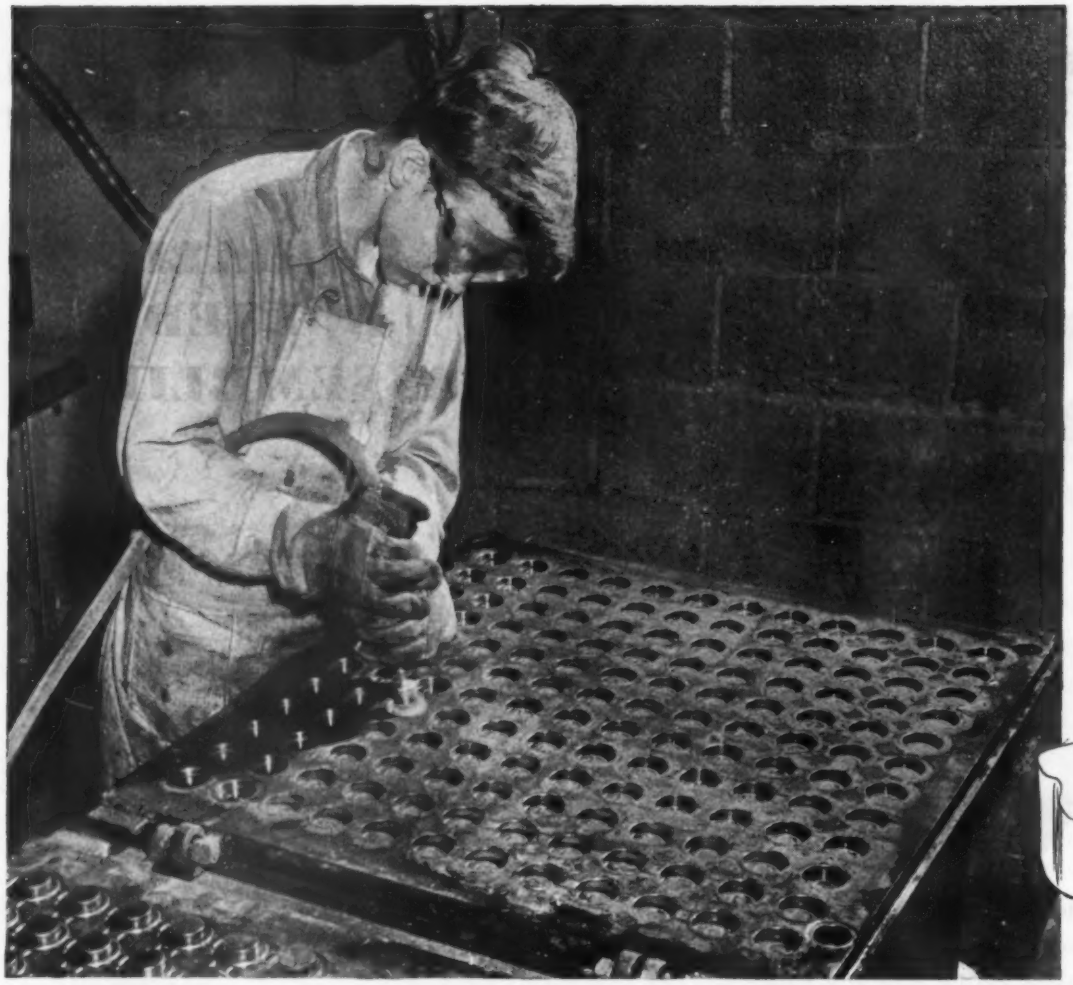

The brush that gets the "inside stuff" on moulds...

DIES AND MOULDS USED IN VIRTUALLY ALL INDUSTRIES ARE KEPT IN PRODUCING TRIM WITH OSBORN BRUSHES

DIES like the one illustrated make parts for every conceivable product. They must be cleaned—thoroughly cleaned and polished or the mould can become fouled and unfit for service. Osborn brushes climb right into those difficult-to-reach contours—removing grease, burned oil, flashings, rubber. And the moulds keep right on producing parts which go into millions of diversified products where they join millions of gears and screws and engine parts which have also been finished with Osborn brushes. Ultimately they will become the ships, automobiles, radios, washing machines and even streamline trains . . . all of which America is waiting to buy.

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The world-famed Taft-Peirce line of precision gages includes a complete line of Thread Gages, both American Gage Design Standard and special styles, some of which are shown. Many of these standard Thread Gages are regularly carried in stock in commonly used sizes.

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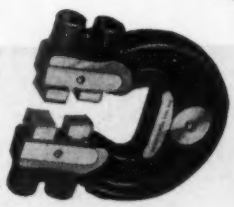
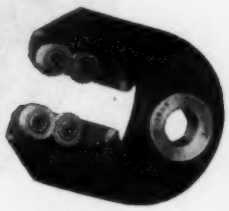
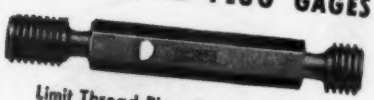


Adjustable Thread Snap Gage, No. 9432

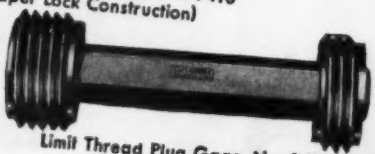


John-Sons Roll Thread Snap Gage, No. 9435

THREAD PLUG GAGES



Limit Thread Plug Gage, No. 9410 (Taper Lock Construction)



Limit Thread Plug Gage, No. 9410 (Reversible Construction)

PIPE THREAD GAGES

At left: Style 9475 Ring Gage
At right: Style 9474 Plug Gage

RING THREAD GAGES

Basic Size Ring Thread Gage, No. 9424

If the Vital Factor i

...in your Production is MACHINABILITY

● Take the case of the two large steel parts on the opposite page. Specifications called for production by forging or casting. But facilities were not available and delivery was urgent—so they were *machined* from cold drawn bars.

Look at the very small parts in the circle. They had to be made on a mass production basis—with costs held down.

Suppose these were your problems. No, they're not difficult—but the vital factor in their production, as in millions of steel parts turned out every year, is MACHINABILITY.

There's no side-stepping this proved fact: The ability of the steel bars you use to take forming, milling, drilling, reaming, threading, tapping and similar operations at high speed and with heavy feed—with a minimum of tool wear—determines the profit you can make in steel parts production.

That's why Republic's Union Drawn Steel Division places MACHINABILITY above all other qualities in cold drawn bars.

Year after year for more than half a century, Union Drawn metallurgists and engineers have spent long hours in the laboratory and in parts producers' plants. They've cut up tons of steel on an automatic screw machine to learn the intricacies of machinability.

And from this research they've been able to steadily increase the machinability of Republic Union Cold Drawn Steels to its present high efficiency—to reduce tool-wearing abrasives to a remarkably low point—and to improve the machined surface.

To further improve machinability, and to assure uniform hardness and physical properties, Union Drawn has greatly increased capacity in all plants for furnace treated cold drawn steels—annealed, normalized, spheroidized, stress relieved and otherwise heat treated.

If the vital factor in your production is MACHINABILITY, Republic Union Cold Drawn Steels can provide it, *as always,* in the high degree for which they have become famous. And Republic metallurgists are ready to help you get best results from these steels.

REPUBLIC STEEL CORPORATION
Union Drawn Steel Division • Massillon, Ohio
GENERAL OFFICES • • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic

UNION COLD DRAWN STEELS

Reg. U. S. Pat. Off.

Free-Machining Bessemer, Open-Hearth and Electric Furnace Steels

•

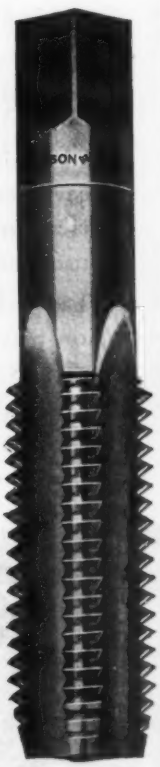
Union Cold Drawn Special Sections

•

Union Cold Drawn and Ground Rounds; Turned and Polished Rounds; and Turned, Ground and Polished Rounds (Union Precision Shafting).

Preparing the way

There is just one way to lick the Axis. Our guns must fire straighter, faster and longer. Remember, when you have a production problem to lick, that H-W Taps produce more precision threaded holes in less time . . . deliver longer, more accurate runs between grinds . . . speed up production by reducing downtime and rejects . . . because the exclusive "Hanson Process" of finishing after hardening insures uniform grain structure from tip to shank. Look for this emblem on the taps you buy.



"HANSON" PROCESS

ARMY E NAVY

THE HANSON WHITNEY MACHINE CO.

HARTFORD CONNECTICUT U.S.A.

Nickel Steel columns guide 14,000 tons to work

This 74-foot Giant has a working stroke of 10 feet.

Pivotally supported rams enable it to deliver, without sway, the full 14,000 ton pressure at 6 feet off center.

Columns of Nickel alloy steel guide this tremendous force. Each column is 66 feet long and 34 inches in diameter, forged and heat treated to assure a minimum yield point in tension of 60,000 p.s.i. with 18% elongation.

These columns exemplify the strength and toughness that Nickel imparts to alloy steel forgings of large cross-section.

The press, a product of United Engineering and Foundry Company, represents a notable engineering and production achievement. It is now turning out gun barrels, ship shafts and other heavy forgings.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET NEW YORK 5, N.Y.

Press lever shoes on the Rahnberg-Jacobsen Automatic Shell Banding Machine are made of Ampco Metal. Each shoe is subjected to a crushing force of approximately 75,000 lbs. during each stroke of the machine. There has been no occasion to replace the Ampco Metal shoes.

No Costly Shut-downs due to metal failures

. . . where machine tool parts are made of wear-resisting AMPCO METAL

Five grades and a number of modifications available – in a form to fit specific needs . . .

To protect you against costly "down time" for repairs due to metal failures, leading machine tool builders (over 90 of them) standardize on parts of Ampco Metal—a *series* of aluminum bronze alloys tailor-made to meet severe operating requirements.

With physical properties that can be regulated to suit the application, versatile Ampco Metal lasts several times as long as ordinary bronzes, The variations retain Ampco's distinctive characteristics: Controlled hardness. High tensile and compressive strength. Stubborn resistance to wear, shock, impact, fatigue, "squashing out." Good bearing characteristics.

Check for this protection against breakdowns in the specifications of machines you buy. Replace worn parts of your older machines with durable Ampco.

AMPCO Metal
The Metal without an Equal

M 14

FREE "File 41—Engineering Data Sheets" illustrates and describes many applications using Ampco Metal successfully. Shows why it's good business to check for Ampco Metal as a mark of quality in the machine tools you buy. Use the coupon at right to request your copy.

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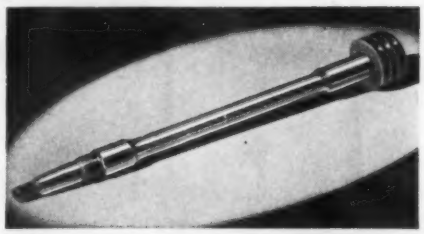
PRECISION PARTS

Lobbing Howitzer Heavies on the Target



Blasting the way through well-fortified lines calls for heavy ordnance—accurately aimed. Because of the long distances from the guns to the target, any errors in the aiming-mechanism are multiplied many times over.

This worm-shaft is part of the sighting-device on a 105-mm. howitzer. Ace machines and grinds them complete from heat-treated forgings. The worm thread, and the class 3 threads at the small end of the shaft, are ground from the solid. The whole job involves very careful machining and grinding and is typical of Ace facilities and abilities.

Here under one roof you will find competent management and modern equipment well qualified for turning out complete parts and assemblies involving stamping, machining, heat-treating, or grinding. The Ace knack of holding pieces to close tolerances and yet turning them out on a mass-production basis offers many worthwhile advantages. Let us quote on your next job. Send blueprint, sketch, or sample.

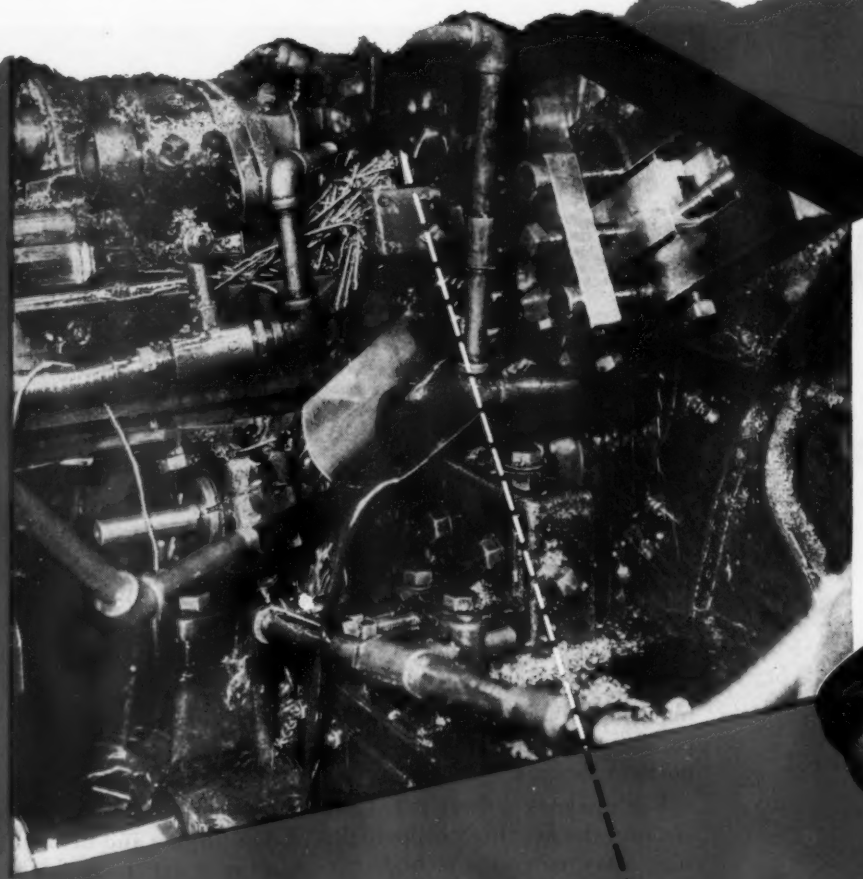
FINE PRECISION *is yours for the asking. Keep a copy in your files.*

ACE
TRADE MARK

ACE MANUFACTURING CORPORATION
for Precision Parts

1207 E. ERIE AVE., PHILADELPHIA 24, PA.

"THE PURPOSE OF ANNEALING MAY BE; (f) TO PRODUCE A DEFINITE MICROSTRUCTURE"
NATIONAL METALS HANDBOOK



The machinist working with annealed steels will omit the word "may" from that statement. The results he can obtain in his machining operations are so greatly dependent on the structure of the steel and its uniformity that he is much concerned with annealing.

Wyckoff's Structure Controlled Annealing reduces variations in machining results by maintaining a uniform satisfactory structure. The elimination of structural variations permits refinement of machining operations to improve efficiency.

ARMY E NAVY

COLD FINISHED STEEL WYCKOFF

WYCKOFF STEEL COMPANY

First Natl. Bank Bldg., Pgh. 30, Pa. • 3200 S. Kedzie Ave., Chicago 23, Ill.

Works: AMBRIDGE, PENNA.; CHICAGO, ILL.; NEWARK, N. J.; PUTNAM, CONN.

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COMPLETE ANNEALING AND HEAT TREATING FACILITIES

There's a NEW

MATERIAL FOR PARTS LIKE THIS...

IT'S CHASE TELNIC* BRONZE

AVERAGE PROPERTIES

Tensile Strength	above 70,000 psi
Yield Strength	above 58,000 psi
Electrical Conductivity (% I.A.C.S.)	50%

YES, the copper alloys, too, are new materials today — materials you will want to study carefully when you plan your postwar designs.

For instance — there's TELNIC Bronze, the first high copper content alloy to combine high corrosion resistance, excellent hot workability, free cutting characteristics, age hardenability, high strength and hardness.

Older copper alloys depended on lead for free machining properties — and lead is highly detrimental to hot working. But TELNIC Bronze uses carefully controlled quantities of *tellurium* in place of lead, making this alloy free machining without affecting its hot working characteristics in any way.

For any part that can best be fabricated by a combination of hot forging and machining... and that must have high strength, excellent corrosion resistance, and reasonably good conductivity... you will find TELNIC Bronze an ideal material. Right now, of course, it is being used entirely for war applications... but we'll be glad to work with you in adapting its unique properties to your postwar plans.

*Reg. U. S. Pat. Office

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MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WASHINGTON†

This is the Chase Network — handiest way to buy brass

† *Indicates Sales Office Only*

A time saving idea was born in a SEAMLESS TUBE

THREE SMALL ARMS CARTRIDGE RECEIVERS made from SHELBY Seamless Steel Tubing by one of the country's leading small arms companies.

. . . and a better product resulted!

IN the exacting production of small arms, certain steel parts must have a normal grain in order that a special finish may be obtained. The life of many an American soldier depends upon the ease, rapidity and reliability of the magazine action of rifles and carbines.

During the manufacturing operations the cartridge receivers have to be drilled, reamed, tapped, threaded, milled, broached, upset and ground to gauges provided and rigidly maintained by the Army Ordnance Department.

Valuable time and money were saved, and an ideal finish was produced when SHELBY Seamless Steel Tubing was used instead of forgings. The number of operations was reduced, and there was a saving in the tonnage of raw material. Due to the uniform hardness of the tube steel, longer life was given to the tools used in the various machining processes.

These cartridge receivers form an excellent example of how the adaptation of SHELBY Seamless Tubing can result in a better product. There are many war and peacetime industrial products which can be manufactured from steel tubing more satisfactorily, more cheaply and more quickly than from solid forgings.

Our service engineers have had ample experience in this direction, and have given valuable assistance to many companies. Perhaps they can help you? If you have a problem of this nature, their services are at your disposal for consultation.

WALLS WITHOUT WELDS

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

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UNITED STATES STEEL

ORANGE
ROLLER BUSHINGS

In the Northrup Black Widow P-61 night fighter—world's largest, most powerful pursuit plane—Orange Roller Bushings take the load in the Nose Landing Gear Drag Brace, which reinforces the hydraulic shock struts.

High Load-carrying capacity in small space

Aircraft designers, who pinch every inch and count every ounce, have brought the science of weight and space saving to its highest development. The use of Orange Roller Bushings in special aircraft equipment and landing gear, verifies the high load carrying capacity in small space which these bearings have exhibited on all types of equipment.

Combining ruggedness with precision, Orange Roller Bushings stand up under severe service. Roller clearances are held to a minimum, thus all internal running clearances are closer, maintaining true alignment of rollers with the highly finished raceways.

Give your equipment the smooth, compact, anti-friction protection of Orange Roller Bushings. Available in a full range of sizes and types for most requirements. Send for Engineering Data Book showing design, sizes, capacities, installation data, etc.

Mail Coupon for Engineering Data

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Orange, N. J.

Please send me your Roller Bushing Data Book

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ORANGE ROLLER BEARING CO., INC.
334 Main Street, Orange, N. J.

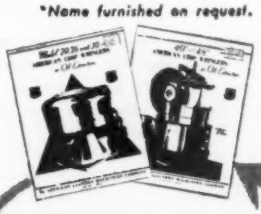
SAVES $98 NET A WEEK Per Screw Machine!

CUTTING OIL CONSUMPTION dropped 36 gallons per screw machine each 24-hour day when a Detroit manufacturer* installed an American Chip Wringer. With oil at 50c a gallon, that's a saving of $18 a day per screw machine, or $5400 a year (300 days).

Deducting 20% depreciation, on an investment of less than $1500 for the American Chip Wringer (including electric hoist), leaves a net saving of $5100 a year, or *$98 clear every week for each screw machine this manufacturer operates.*

Savings like that aren't unusual. Let us show you how much money an American Chip Wringer will save *you*. There's no obligation. Write today!

*Name furnished on request.



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Fully illustrated, describing five models of American Chip Wringers

In less than 3 minutes, an American Chip Wringer reclaims more than 90% of the cutting oil from a load of metal chips or machine turnings. Can be operated by any unskilled person.

The AMERICAN LAUNDRY MACHINERY COMPANY
CINCINNATI 12, OHIO

...AN ENDLESS JOURNEY

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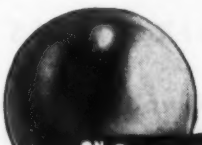
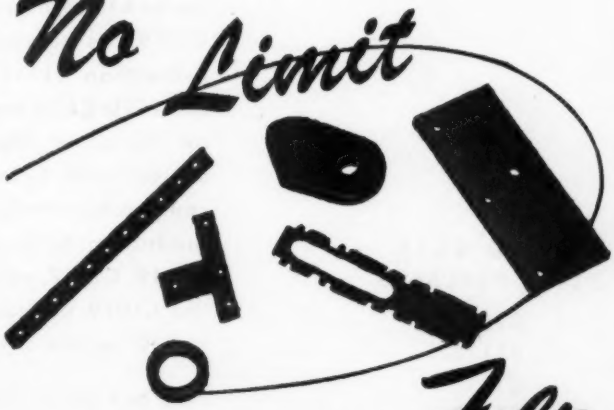
Heavy duty applications, light assemblies, intricate mechanisms—all carry the load as planned with ABBOTT BEARING BALLS on the job. They have the stamina, uniformity, and precision to stand the gaff of grueling service. . . . For uninterrupted performance start ABBOTT BEARING BALLS on their endless journey in your bearing races.



UNINTERRUPTED PERFORMANCE
Specify "ABBOTT" and be sure.

ROLL ON ABBOTT Bearing BALLS
THE ABBOTT BALL COMPANY HARTFORD 10, CONN. U.S.A.

No Limit



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Because Western Felt can be processed from wool softness to rock hardness, and because it can be made into any desired shape or size, it is being used today as channels, gaskets, washers, padding, lubrication wicks and seals, thermacoustic insulation and machinery mounts, and as an alternate for critical materials.

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one of them is

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ITS COMBINED PROPERTIES GIVE YOU SIX STEELS IN ONE

Revolutionary SPEED CASE STEEL replaces satisfactorily six or more comparable steels, each possessing a necessary characteristic for special operations. SPEED CASE STEEL machines as fast as B1113, its ductility equals C1019, its tensile strength is better than C1117. Tools used on SPEED CASE last longer than on Bessemer Steels—its machined finish is better than all comparable steels. It increases production 40% to 80% over C1019, C1117, etc. It carburizes like C1019. It is saving users up to $70 per ton of steel used.

SPEED CASE STEEL REPLACES

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C1115
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a collective-bargaining guide to save you serious missteps

Here at last is a clear and authoritative new book that meets the increasing demands being made upon you to express your personnel policies and procedures in the rigid and binding terms of written agreements. It shows what management representatives need to know about their own interests and those of employees and unions. It describes the collective-bargaining techniques — and gives the clauses that will best meet the interests of all involved, *without restricting management's logical functions of direction and operation of the business!*

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and CHARLES R. HOOK, JR.
Secretary, Rustless Iron and Steel Corporation

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. . . as these Quick and Easy-Driving AMERICAN PHILLIPS SCREWS"

Yes, it always boosts the morale of workers when they're freed from the slow, exhausting, dangerous work of hand-driving slotted screws . . . and switched onto the fast, effortless, safe method of power-driving American Phillips Screws.

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In factories and machine-shops, Anti-Corrode is widely used to protect metals and metal products in storage, transit or in process of manufacture.

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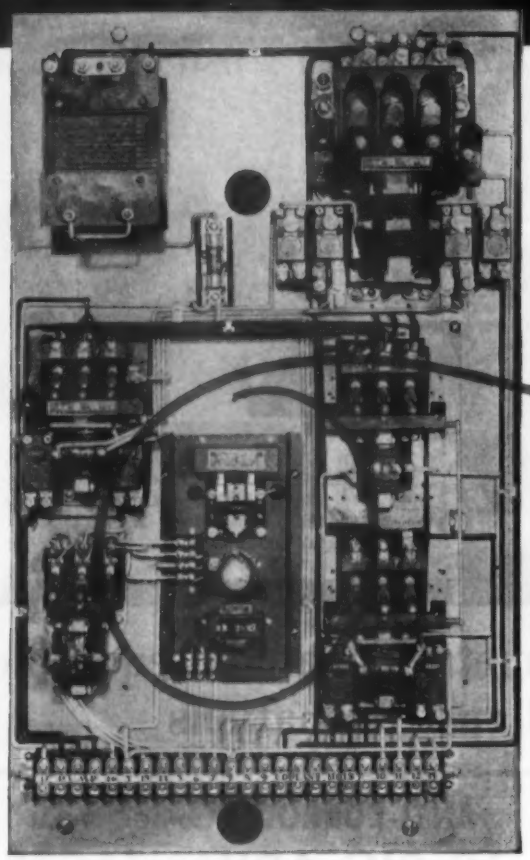
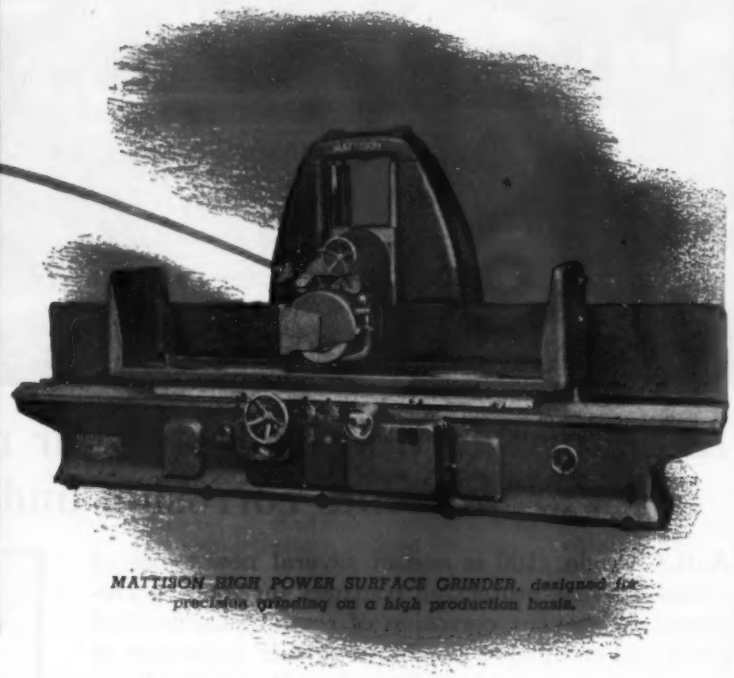
MATTISON ATTAINS NEW HIGHS in PRODUCTION and PRECISION with "3C" ELECTRONIC CONTROL



"3C" Control Panel for Mattison Grinder, with Electronic Timer (circled in red) to time the travel of the cross-feed.



MATTISON HIGH POWER SURFACE GRINDER, designed for precision grinding on a high production basis.

● The new Mattison Precision Surface Grinder typifies machine tool engineering at its best—high power, wide range, large capacity, production speed, ruggedness and such extreme accuracy that it can be used on many jobs formerly hand scraped.

Control for such a machine is vitally important. The operation of the 4 motors, ranging from ¾ to 30 H.P., presented no particular problem. Control equipment consists of individual magnetic starters providing overload and undervoltage protection for each motor, with control transformers and relays installed in a dustproof cabinet.

But the application of the "3C" electronic timer reflects the ingenuity of the tool designer, cooperating with Clark engineers. Bulletin 7313 type ET 20 Electronic Timer is specially designed to time the travel of the cross feed. Entirely automatic, it has a time range of 1/10 to 1 second, providing wheel feeds adjustable to width of wheel. It is designed for 40 operations per min., 24 hrs. a day. Timer has only one tube and few moving parts—enabling it to operate millions of times with minimum maintenance.

Clark specializes in controls for modern, high speed machine tools. Let Clark engineers help you design the proper controls for your equipment.

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Helping manufacturers to build real service into their product is a welcome assignment for Johnson Bronze. Simply call in a Johnson Engineer. Permit him to study your applications. Provide him with adequate information . . . speeds . . . loads . . . shock . . . or other operating conditions. He will give you the right solutions . . . based on facts . . . free from prejudice. Manufacturers giving thought to their postwar product will do well to consult with Johnson Bronze *now*.

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515 S. MILL ST. NEW CASTLE, PA.

Branches in 18 Industrial Centers

JOHNSON
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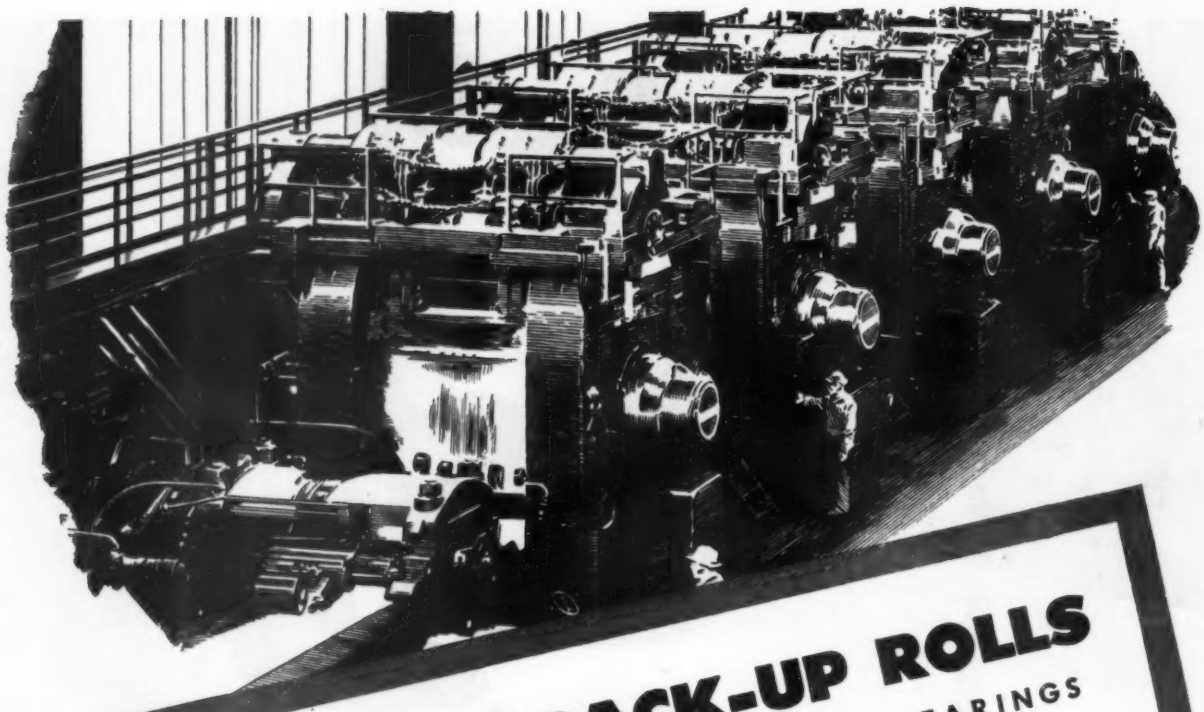
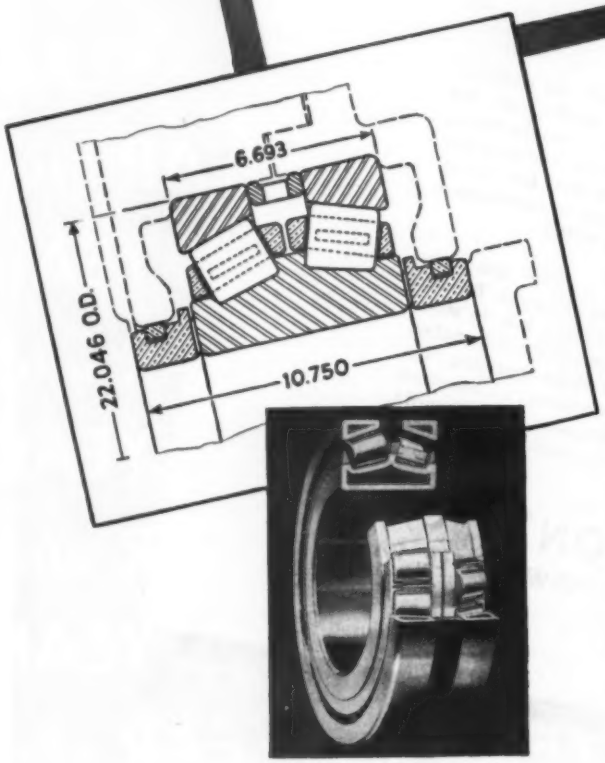
BRONZE



BEST FOR BACK-UP ROLLS

CHROME NICKEL STEEL ROLL NECK BEARINGS HELP SET PEAK TONNAGE RECORDS



Torrington's two-row tapered roller bearings made of S.A.E.-3310 steel (with higher nickel content), carry the thrust loads imposed on the back-up rolls of this 80" four-high continuous hot strip mill. They provide a much-needed anti-friction application which helps achieve peak wartime tonnages. Features include simplicity of design, controlled lubrication and clearances which permit ready removal from roll necks. Each bearing has a thrust load capacity of 220,900 pounds at 100 r.p.m.—employing 23 rollers, 2¼" long by 2" in diameter, in each of the two rows.

Supplying steel, oil, paper, machine tool and other industries with custom-made bearings for heavy-duty operations is an important function of Torrington's Bantam Bearings Division. Consult Torrington's engineering staff when you have an anti-friction problem, standard or unusual.

THE TORRINGTON COMPANY • BANTAM BEARINGS DIVISION
SOUTH BEND 21, INDIANA

TORRINGTON BEARINGS

STRAIGHT ROLLER • TAPERED ROLLER • NEEDLE • BALL

Magnesium alloys are easily joined by every common method

Riveting—gas, arc, spot and flash welding all do the job

Matchless lightness has earned for magnesium an industry-wide reputation. It's when you come to build this lightness into your product that you first fully appreciate magnesium's many important fabrication advantages.

Easy joining is a major one. Magnesium readily lends itself to every joining method in common use, including riveting and gas, arc, spot, and flash welding. Procedures are very similar to those employed with other metals.

Riveting is the method most widely used for joining magnesium sheet and extrusions, and various Dowmetal Magnesium Alloys in these forms—as well as sand castings—can also be gas and arc welded. Spot and flash welding each serve definite fabrication requirements.

Dow has taken active part in the development of these techniques, and the resultant data is now available to you. The nearest Dow office will give you technical assistance in the best procedures to use in your own product.

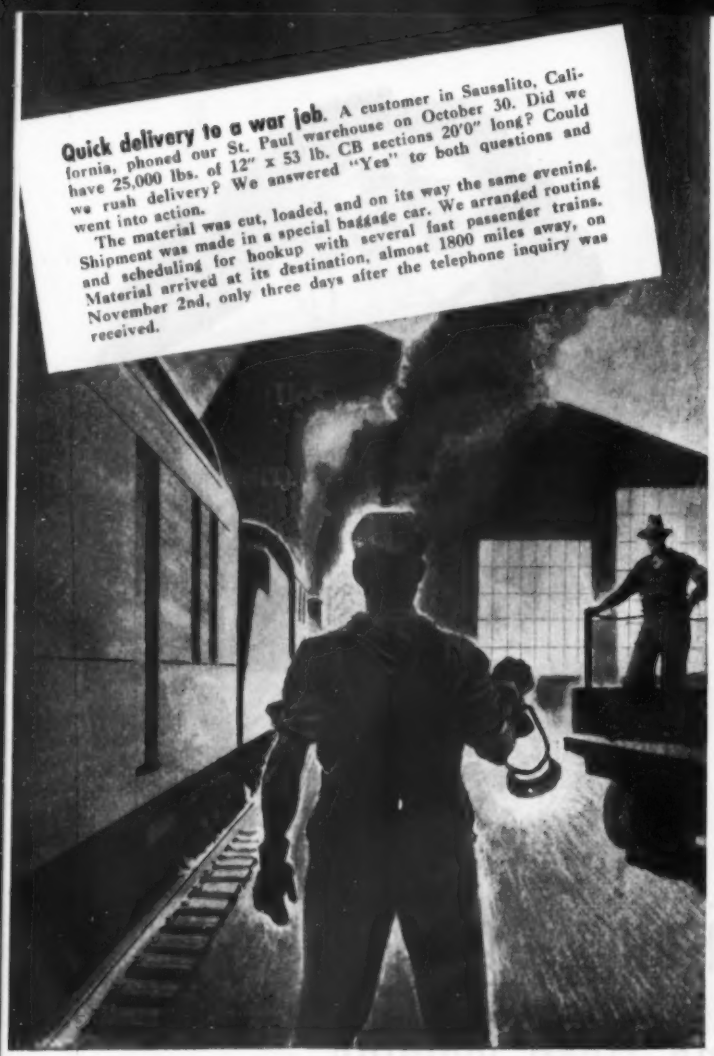
DOWMETAL

magnesium

THE METAL OF MOTION

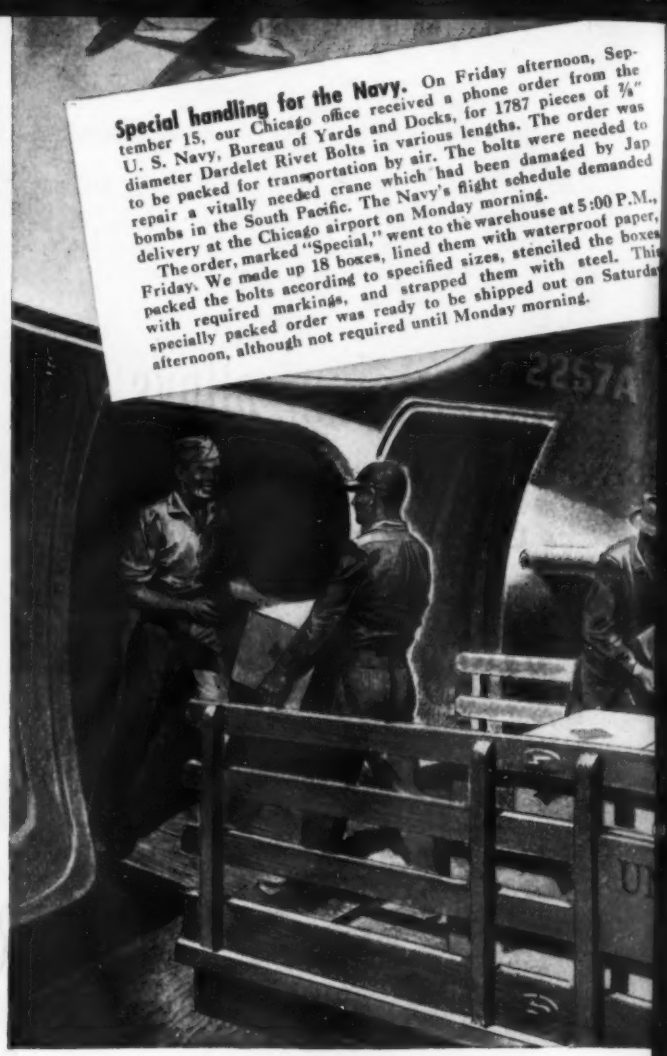
MAGNESIUM DIVISION, THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle



Quick delivery to a war job. A customer in Sausalito, California, phoned our St. Paul warehouse on October 30. Did we have 25,000 lbs. of 12" x 53 lb. CB sections 20'0" long? Could we rush delivery? We answered "Yes" to both questions and went into action.

The material was cut, loaded, and on its way the same evening. Shipment was made in a special baggage car. We arranged routing and scheduling for hookup with several fast passenger trains. Material arrived at its destination, almost 1800 miles away, on November 2nd, only three days after the telephone inquiry was received.



Special handling for the Navy. On Friday afternoon, September 15, our Chicago office received a phone order from the U. S. Navy, Bureau of Yards and Docks, for 1787 pieces of ⅞" diameter Dardelet Rivet Bolts in various lengths. The order was to be packed for transportation by air. The bolts were needed to repair a vitally needed crane which had been damaged by Jap bombs in the South Pacific. The Navy's flight schedule demanded delivery at the Chicago airport on Monday morning.

The order, marked "Special," went to the warehouse at 5:00 P.M., Friday. We made up 18 boxes, lined them with waterproof paper, packed the bolts according to specified sizes, stenciled the boxes with required markings, and strapped them with steel. This specially packed order was ready to be shipped out on Saturday afternoon, although not required until Monday morning.

If it's service you want... *Call us*

OUR warehouses today have large stocks and a good variety of steel available for quick shipment. When you need steel, phone, write or wire our nearest warehouse. We may be able to help you solve a production problem—avoid serious delay on a war job. Our stocks include NE Alloy Steels which have proved as good or better in many applications than steels ordinarily used. Your inquiries will receive careful attention and quick action.

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UNITED STATES STEEL

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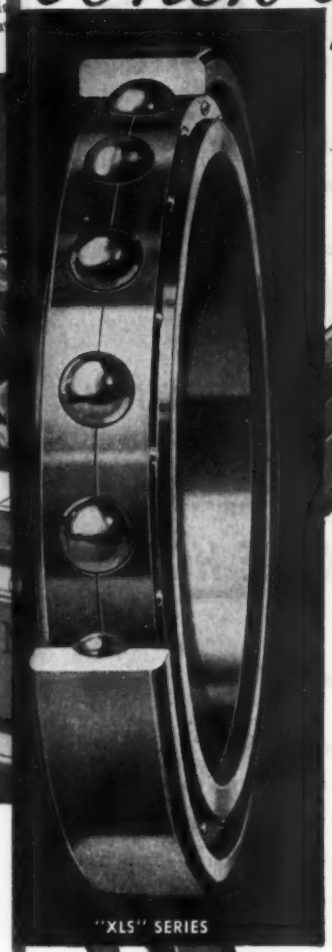
USE THESE VERY LIGHT INCH SERIES BEARINGS

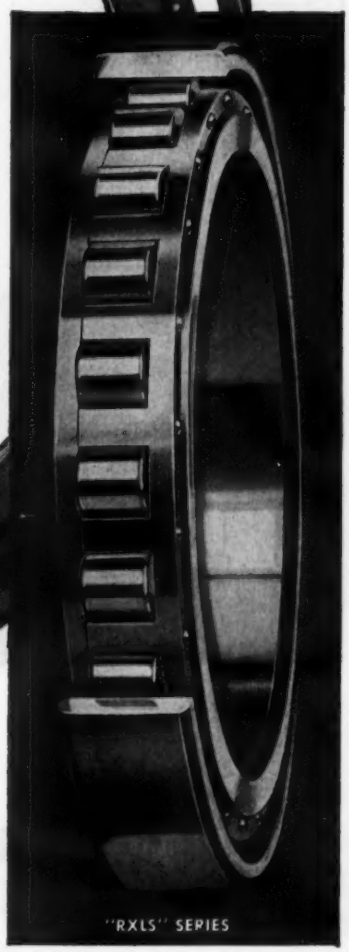


"XLS" SERIES

HAVING bores abnormally large, as compared with the outside diameter, they offer definite advantages under certain conditions found in machine design. You may have them in several different types, *affording compactness, light weight, and greater latitude in your design.*

There are several lines of very light type ball bearings, which include the "S" starting at 1/8" bore, and the "XLS" starting at 1 3/8" bore, running up to a maximum of 21" bore and 28" outside diameter. And in very light type roller bearings, there is the "RXLS" Series, paralleling the "XLS" in size range.

Why not let our engineers tell you more about these Very Light Precision Bearings? Write for the Catalog.



"RXLS" SERIES

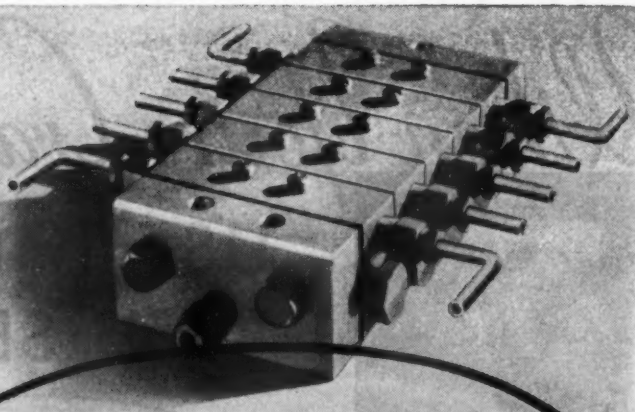
"NORMA-HOFFMANN"

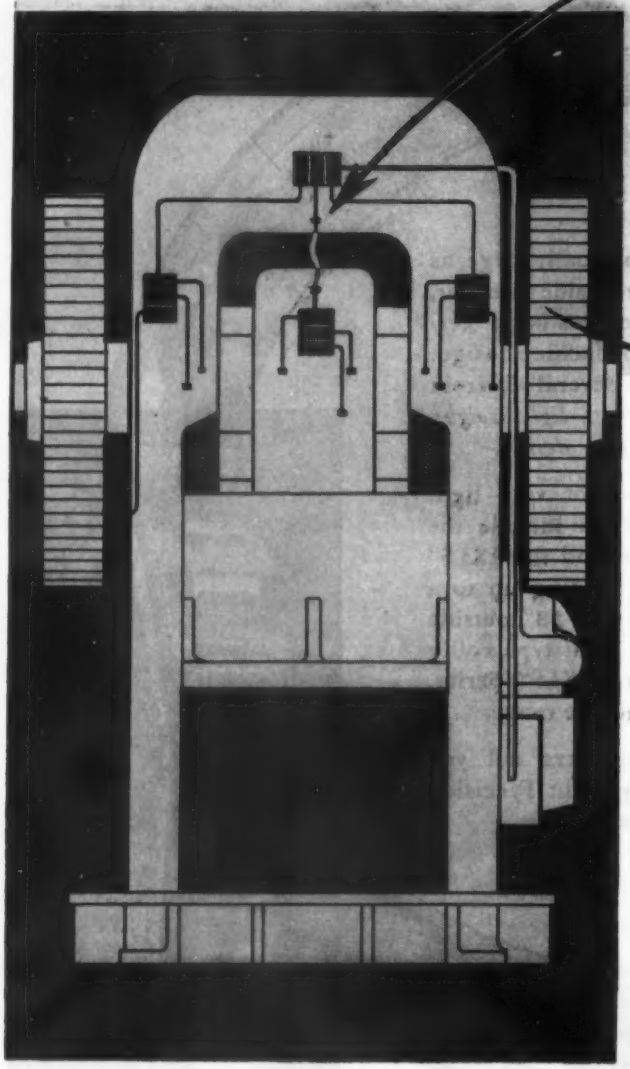
PRECISION BALL, ROLLER AND THRUST BEARINGS

NORMA-HOFFMANN BEARINGS CORP'N. STAMFORD, CONN., U. S. A.

With

TRABON TYPE M
POSITIVE CENTRALIZED
LUBRICATION





You can reach all the bearings on a moving machine member with JUST ONE FLEXIBLE HOSE

● It's easy. You simply take a Type "M" Distributor having discharge characteristics that meet the requirements of the bearings to be lubricated,—mount it on the moving machine part—run fixed leads to the bearings,—and connect the distributor to a suitable source of lubricant on a stationary machine member, with *just one* flexible hose.

Saving hoses, and reducing maintenance, is just one service-proved advantage of Trabon Type "M" Lubrication. Easy installation, unbelievably low cost,—manual, or automatic operation that reduces the human factor simply to keeping the reservoir filled,— are some of the other reasons why every machine owner, and every machine user, should get the full story from Bulletin No. 442. Send for a copy today. •

TRABON
ENGINEERING CORPORATION

1819 East 40th Street, Cleveland 3, Ohio • Industrial Lubrication Exclusively Since 1922

ORIGINATORS AND PATENT OWNERS OF THE SINGLE LINE REVERSING LUBRICATING SYSTEM

In Thousands of *WAR PLANTS*

GATES *Synthetic Rubber* V-Belts

—are giving *BETTER SERVICE*

Than Any V-Belts Ever Made of NATURAL RUBBER!

To meet the unprecedented severity of combat service on U. S. Army tanks, tractors and self-propelled big guns, Gates has developed and built synthetic rubber V-belts to far higher service standards than were ever required of pre-war, natural rubber V-belts!

- **The importance of this fact to industrial V-belt users is this:**

  Every improvement developed by Gates for these Army V-belts has also been added, day by day, to the quality of the standard Gates Vulco Ropes which have been delivered to you.

In the case of many other products, you must wait until after the war to get the benefit of war-time improvements. But victory depends upon production—and production depends upon V-belts which drive the producing machines. That is why Gates has been able to pass on to you immediately, in your Standard Gates Vulco Ropes, every V-belt improvement which Gates specialized research has developed for use in the Army's motorized equipment.

In addition, where V-belts of special construction are required your Gates Rubber Engineer can supply a Gates V-belt that is precisely engineered to meet your special needs. Whenever you have a drive problem or a V-belt problem, just pick up your telephone directory and look under the heading "Gates Rubber." The Gates Rubber Engineer will bring right into your plant the full benefits of every advance in V-belt construction that Gates specialized research has developed.

—and one of these 5 GATES V-belts will meet any Special need you may have.

- Rayon Cord V-Belts
- Static-Safety V-Belts
- *Special* Synthetic V-Belts
- Cotton Cord V-Belts
- Steel Cable V-Belts

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Engineering Offices and Jobber Stocks in All Large Industrial Centers

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Now...

Now in today's stress of plane warfare and all-out war production of machine tool products — Curtis Universal Joints are proving that Curtis "Standards" of quality meet every demand for dependable operation.

For all types of plane controls and in the thousands of universal joint applications on machine tools which are turning out munitions, planes, tanks and other machine tools — Curtis Universal Joints meet all requirements of smooth, positive action with low maintenance.

And when new planes or new machine tools of the future are designed and developed — Curtis will have the answer to their universal joint needs.

If any of 14 Standard joints do not meet unusual demands, Curtis Engineers, with more than 20 years of experience in solving difficult universal joint problems, will design a Curtis joint to do the job.

Use this experience and knowledge right at the start of your designing and planning — let us work with you now on your future ideas.

Write for technical data and useful templates.

and When!

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SOLE DISTRIBUTORS, BOSTON GEAR WORKS, NO. QUINCY, MASS.

USE HEADED AND THREADED FASTENERS FOR ECONOMY AND RELIABILITY

Alloy Steel BOLTS · NUTS STUDS

Every standard alloy steel fabricated into bolts, nuts, studs and many special fastenings. Accurately made in standard dimensions or to meet your specifications.

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A full line in carbon steel, heat-treated alloy steels, stainless steel, silicon bronze, brass, bronze, and monel metal.

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THE PLACE TO SOLVE YOUR BOLT PROBLEMS

Bunting, largest producer of Cast Bronze Bearings for Aircraft Engines, has the skill, experience and equipment to make equally fine Cast Bronze Bearings for many other applications. These bearings excell in precision, fine finish and uniform physical and metallurgical qualities. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Warehouses in principal cities.

Bunting

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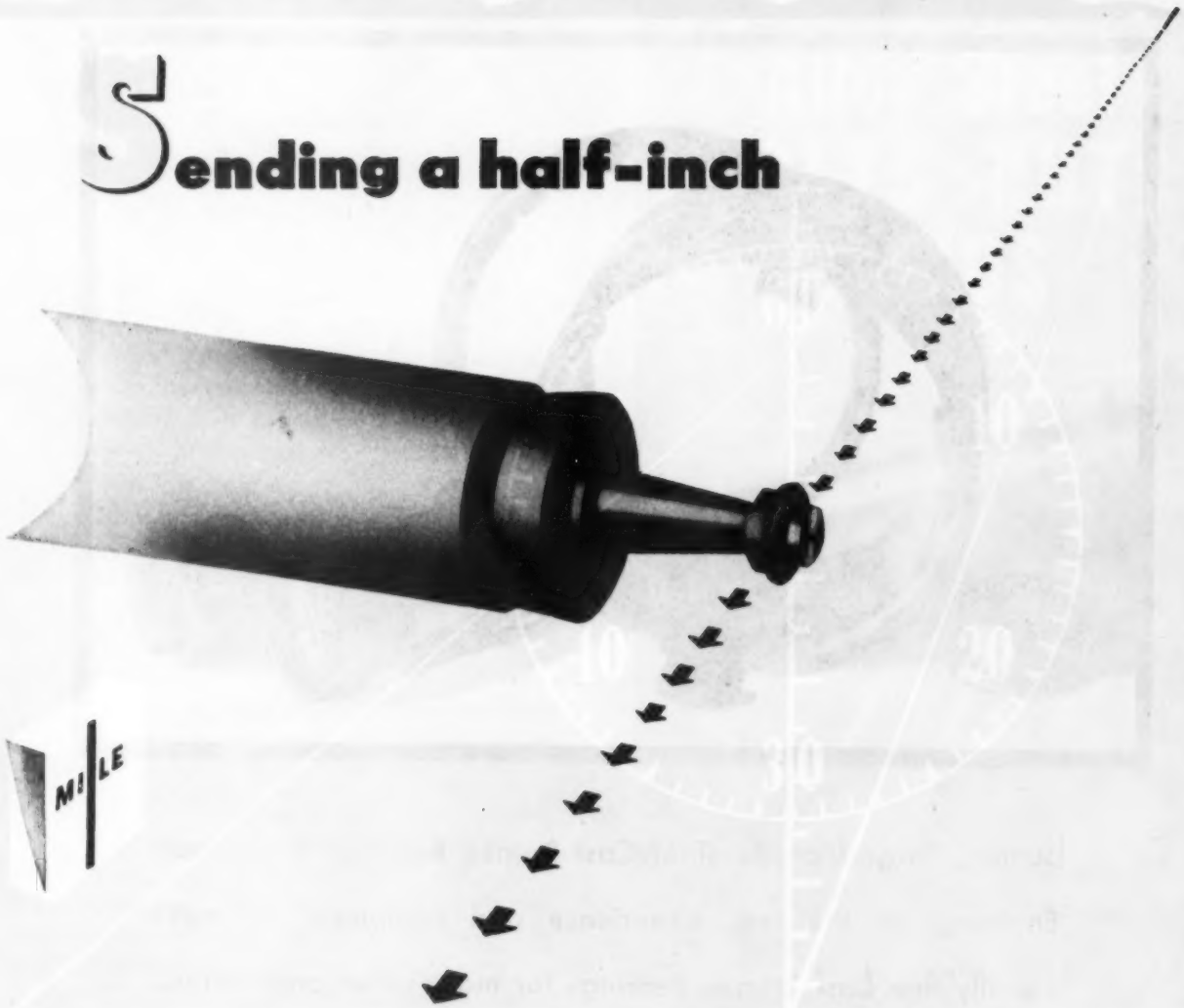
14

Sending a half-inch

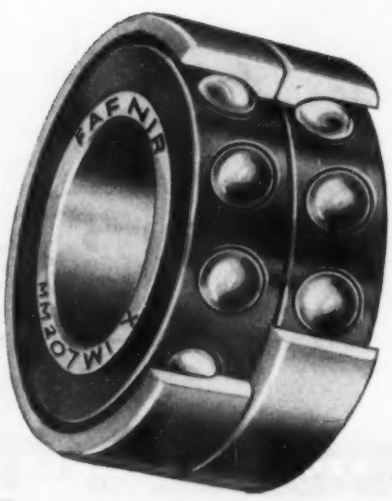


on a mile-a-minute errand

Getting 5000 peripheral feet a minute with a 4-inch grinding wheel poses no serious speed problems. But, to do that with a half-inch grinding wheel, speed must be stepped up to 40,000 r.p.m. And the maintenance of that speed hour after hour is a job for ball bearings.

More than that, it's a job for which Fafnir Super-Precision Bearings were specifically made. In the Fafnir Super-Precision Department, the "factory-within-a-factory," balls for these bearings are matched to unbelievable limits. And pairs of these bearings are matched so carefully that variations between assembled bearings are reduced to millionths of an inch. Properly mounted, these bearings eliminate harmful deflection, maintain inherent rigidity and give *truly accurate* production required today in so many industries.

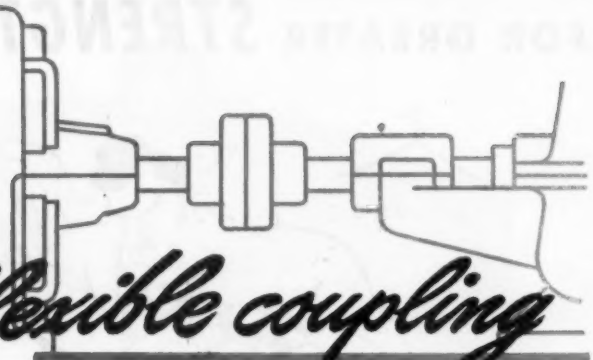
The same Fafnir engineering skill and experience which made possible our own Super-Precision Department are available to help you lick your bearing problems. The Fafnir Bearing Company, New Britain, Connecticut.



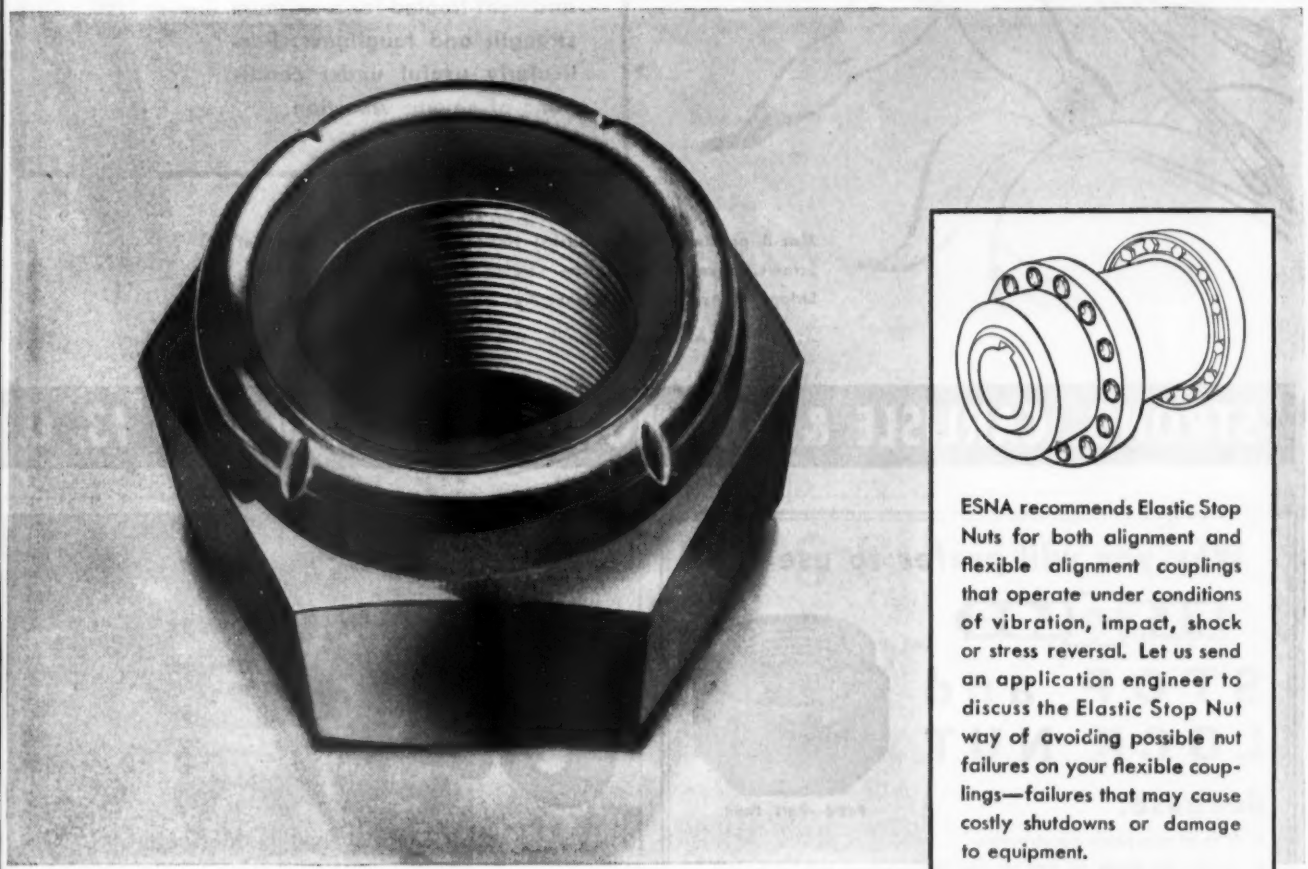
MM200WIX SERIES
Extreme precision, preloaded duplex pairs, for speeds of 40,000 r.p.m. and more.

FAFNIR BALL BEARINGS
Most Complete Line in America

IT'S THE NATURAL THING



— for a flexible coupling



ESNA recommends Elastic Stop Nuts for both alignment and flexible alignment couplings that operate under conditions of vibration, impact, shock or stress reversal. Let us send an application engineer to discuss the Elastic Stop Nut way of avoiding possible nut failures on your flexible couplings—failures that may cause costly shutdowns or damage to equipment.

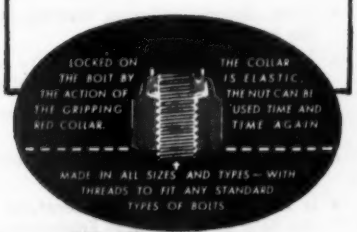
The Elastic Stop Nut uses its head. It has what it takes to stay put in a coupling, no matter how tough the operating conditions.

Built into the head of every Elastic Stop Nut is a locking device — an elastic compression collar.

This collar forms itself to the individual bolt thread, grips it tight. The nut won't loosen up or back off under conditions of severe vibration, shock or impact.

When you use Elastic Stop Nuts you need no cotter pins, no lockwashers or any other auxiliaries with their attendant increase in assembly and servicing costs. And you can turn them up to the torque you need and be sure they will stay there. No backing up or straining to find a cotter-pin hole. They can be used over and over again yet still lock. You can use them on any standard bolt.

Here is sure insurance against loose nuts which will result in reduced coupling maintenance costs.


LOCKED ON THE BOLT BY THE ACTION OF THE GRIPPING RED COLLAR.
THE COLLAR IS ELASTIC. THE NUT CAN BE USED TIME AND TIME AGAIN
MADE IN ALL SIZES AND TYPES — WITH THREADS TO FIT ANY STANDARD TYPES OF BOLTS

ESNA

TRADE MARK OF
ELASTIC STOP NUT CORPORATION OF AMERICA
Union, New Jersey
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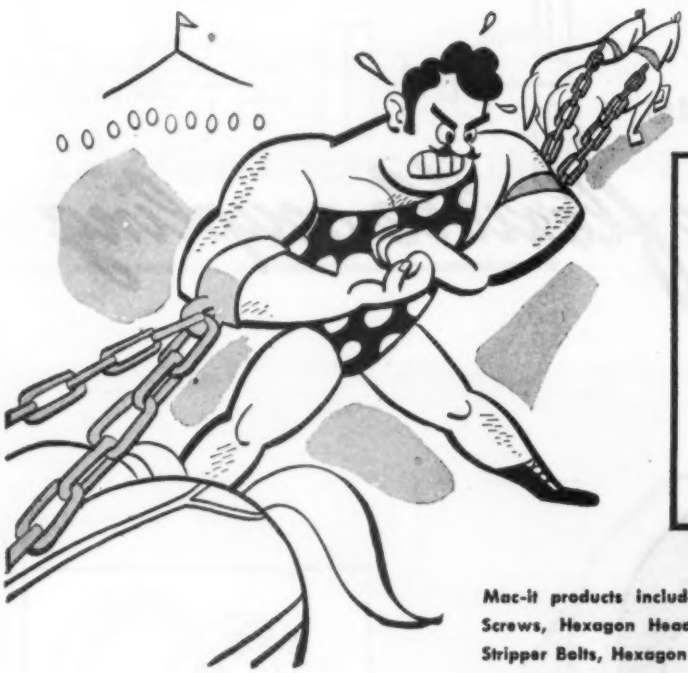
Sales Office—1060 Broad St., Newark 2, N.J.

ELASTIC STOP NUTS
Lock Fast to Make Things Last

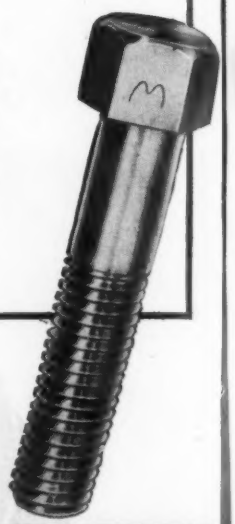
FOR GREATER *STRENGTH* AND *HOLDING POWER*



...SPECIFY *Mac-its*

PRONOUNCED "MACK-IT"

Mac-it alloy steel hexagon head cap screws are tested for minimum tensile strength of 145,000 lbs. per square inch and heat-treated for maximum strength and toughness. Particularly useful under conditions of severe vibration.



Mac-it products include Socket Head Cap Screws, Hollow Set Screws, Hexagon Head Cap Screws, Square Head Set Screws, Stripper Bolts, Hexagon Socket Pipe Plugs.

All are made of alloy steel and heat-treated

STRONG, CARLISLE & HAMMOND CO. • *Cleveland 13, O.*

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FLEXLOC

STOP and LOCK NUT

Pat'd—Pats. Pend.

Because:

- It is of one-piece construction
- It can be made of any of the conventional nut materials
- Every thread—including locking threads—takes its share of the load
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- It accommodates itself to a very wide range of thread tolerances
- It can be used over and over again without losing its ability to lock
- It is not affected by temperatures likely to be met with in the field of Mechanical Engineering
- Being a "stop" nut, it stays locked in any position on a threaded member.

ARMY E NAVY

Sizes from No. 6 to 1" diameter

MILLIONS IN USE

Write for Bulletin 582

The famous "Unbrako" Socket Screw Products are also made by us.

OVER 40 YEARS IN BUSINESS

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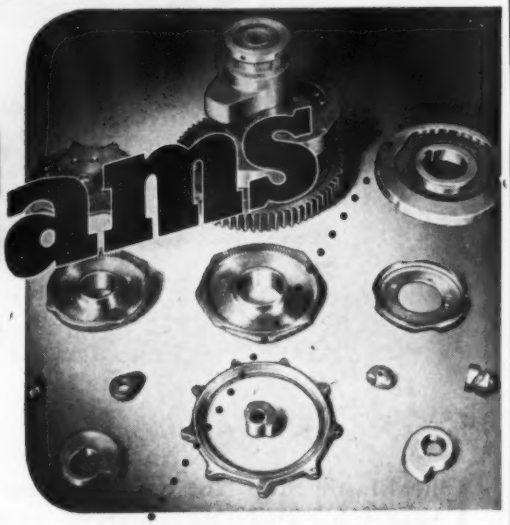

● **25 YEARS** of experience in making special cams for thousands of companies has made us experts at cam cutting and grinding. Our facilities and equipment, the most complete of any plant in the country, permits us to manufacture any style or size of Cam, Geneva Motion, or Scroll Plate in quantities of 1, 10 or 10,000. Accuracy can be held to split thousandths, and surfaces to micro-finishes. Send us specifications or blueprints and we will be glad to submit a detailed quotation to you on your requirements.

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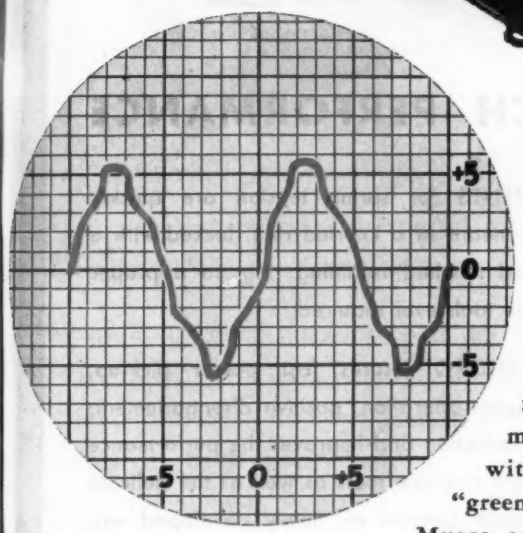

Jumping-off place for small-motor Jitters!

Done for, finished, never to be found in your factory is the fractional horsepower motor that gets caught here with the "shakes." For this "green-line" test tells Robbins & Myers engineers when a midget motor has fidgets, when magnetic or mechanical motor unbalance is causing excessive vibration. Needless to say, any design that doesn't purr along smoothly calls for a new start—from scratch.

In this test, all motor vibration on the spring-supported platform registers on the spherical pickup under the motor. This vibration, in turn, registers on the cathode-ray oscillograph where its magnitude and frequency can be studied from the green line on the screen.

This test is but one of many that newly designed R & M fractional motors must pass. Constant checking of data calculations is a habit with R & M engineers, a habit that assures your satisfaction. That's equally true whether those motors are the stock type or are designed for special performance applications.

In either case, our motor development engineers will be glad to discuss your postwar motor needs, now. Talk it over with them (naturally, without obligation) or ask for literature on the R & M fractional motor line. Today isn't a bit too soon.

FREE NEW BOOKLETS!

"SHADED POLE MOTORS," Form No. 1887. "MATCHED MOTOR PARTS," Form No. 1871. "UNI-SHELL INTEGRAL H.P. MOTORS," Form No. 1845. "MOTOR GENERATOR SETS," Form No. 1881

Send for any or all of these booklets, now.

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Floating Disc CLUTCHES

The JOHNSON... MAXITORQ *Floating* DISC CLUTCH

A *NEW* STANDARD IN CLUTCH PERFORMANCE

- MAXITORQ design permits manual assembly . . . adjustment . . . take apart. No tools are required. This feature is a great convenience and time-saver . . . you can't go wrong.
- FLOATING DISCS ride free in neutral . . . kept apart by unique Separator Springs. You can see between them. No drag . . . abrasion or heat.

TYPES . . . CAPACITIES

MAXITORQ clutches are made in single (left) and double (above) types, wet or dry. Pulley and Cut-Off Coupling types also made. Capacities from ¼ to 5 H.P. at 100 R.P.M.

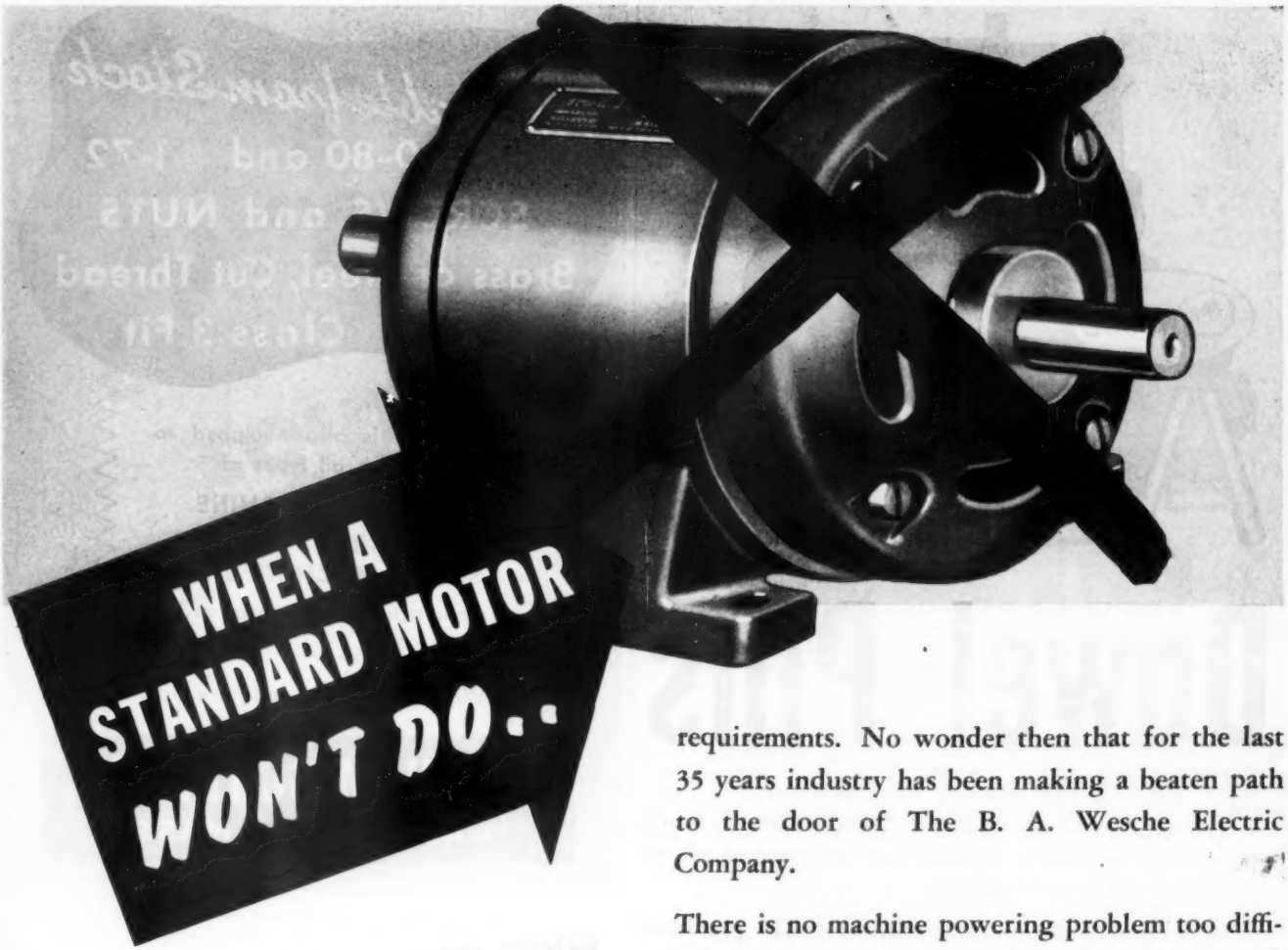
ADJUSTMENTS for spring tension are quickly made by means of a knurled ring, locked with a spring and notched retaining ring, to a proper setting. No tools ever required.

The MAXITORQ insures fast power pick-up, smooth, quiet operation, positive disengagement; speeds production and improves the performance of standard machine tools as well as the delicate and intricate controls on newly developed war production instruments. Because the discs have flat, true surfaces and accurate duplication of thickness, there are no high or low spots under engagement. The entire surface area is engaged, with contact evenly distributed. Obviously, clutch life is greatly extended.

Machine designers and manufacturers are invited to consult with our engineers on power transmission problems. We will supply engineering data on standard MAXITORQ clutches from ¼ to 5 H.P. at 100 r.p.m., or give you details on special sizes.

Send for Catalog No. A41

THE CARLYLE JOHNSON MACHINE COMPANY · MANCHESTER, CONNECTICUT



—consult the specialist of special torque motors, The B. A. Wesche Electric Company.

Manufacturers of machine tools and machines of every description have come to Wesche with their special powering and application problems. Not one went back empty-handed. Their problems were solved by a Welco Torque Motor, custom-built to meet all the special or specific powering requirements. No wonder then that for the last 35 years industry has been making a beaten path to the door of The B. A. Wesche Electric Company.

There is no machine powering problem too difficult for our engineers to solve. Your inquiry will receive prompt and cooperative attention. Write today.

EXCLUSIVE FEATURE

The "Uni-frame" construction of the Welco Torque Motor provides for an easy interchange of A. C. and D. C. motors to fit the same housing or frame. Only WELCO has this vitally important feature.

THE B. A. WESCHE ELECTRIC CO.

1624-2 Vine St. Cincinnati 10, Ohio

Dowel Pins

They serve as locating pins for the diemaker's work — and then go on to general duty as pins and pivots in various machine assemblies.

By their accuracy and strength they *retain* precision standards in tool and die and machine assemblies under punishing stresses.

They are ground to a limit of .0002″ over basic size, with an allowable tolerance of plus or minus .0001″. Surfaces are finely polished; subsequently treated with a rust-preventive.

Metallurgically in a class with ALLEN Hex-socket Screws: — made of the same special-analysis *ALLENOY* steel, heat-treated to an extremely hard surface, with a core of the right toughness to prevent "mushrooming" when driven into a tight hole... Tensile strength, 240,000 to 250,000 lbs. per sq. inch... Typically the Allen high safety-factor in HOLDING-POWER.

Ask your local ALLEN Distributor for samples and dimensional data . . . the same Distributor who serves you dependably with Allen Hex-socket Screws and other "life-lines" of essential supplies.

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SCREWS and NUTS
Brass or Steel, Cut Thread
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SPECIAL MACHINE SCREWS and SCREW MACHINE WORK

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Throughout industry, the Tuthill Model C general purpose pump is recognized for its low first cost, negligible maintenance and long economical service. Simple in design, compact and built for rugged service, this internal gear rotary pump handles non-corrosive liquids. Operates efficiently in either direction of rotation. Capacities from 1 to 200 g.p.m. at pressures up to 100 p.s.i. Direct drive, belt drive, V-belt units and stripped models available. Write for Model C bulletin.

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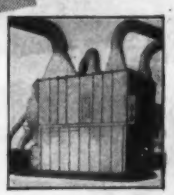
That is why Kirk & Blum systems are unmatched for efficient, dependable, economical performance . . . why leading industries throughout the nation turn to Kirk & Blum for service in this important field.

For 38 years our Engineering Staff has specialized in dust and fume control.

KIRK AND BLUM



BUY MORE WAR BONDS *for* TOTAL VICTORY

The procedure of our staff involves three main steps: (1) Analysis of your special dust or fume control problem; (2) Selection of the right units — wet, dry, or centrifugal — for your particular needs; (3) Design and installation of a complete system *guaranteed* to give you the results you want.

You can avoid many "headaches" in dust and fume control by getting the experienced, unbiased counsel of Kirk & Blum Air Engineers. For details, write to The KIRK & BLUM MFG. CO., 2823 Spring Grove Ave., Cincinnati 25, Ohio.

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TOMORROW'S LIFT TRUCKS TODAY

HYSTER

HYSTER COMPANY places great emphasis on sound engineering. Hyster's Industrial Lift Truck Division maintains a large staff of office and field technicians. Their responsibility is constantly to improve Hyster lift trucks so that they will give long, heavy-duty trouble-free performance.

For example, consider the Hyster "150" Lift Truck. This model has a capacity of 15,000 pounds with speeds up to 35 miles per hour. It's big. Yet hydraulic steering makes it easier to handle than a passenger car.

The Hyster "150" is equipped with pneumatic tires—and all tires and wheels are the same size. Full hydraulic braking system on front wheels and differential give unusually large braking service . . . Standard controls; four speeds forward and reverse; a powerful six-cylinder gas motor make the "150" a versatile power house on wheels.

The operator of a Hyster "150" has excellent visibility and fingertip control for both truck and lift.

All of these—and other features—make the Hyster "150" an excellent value for any business in which materials handling is an important item. Write for illustrated literature on the model that best suits your needs—the "20" (2,000 pounds capacity), the "75" (7,500 pounds capacity) or the "150" (15,000 pounds capacity).

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Pioneers in Materials Handling Equipment

Hyster "150" Lift Truck (15,000 lbs. capacity) loading shipment on cargo plane

HYSTER

Take a handful of Corbin Screws

You'll see clean, saw-cut slots or true-shaped Phillips recesses, well-formed heads correctly centered over strong, straight shanks; deep, keen threads with sharp points.

You'll see what we mean by *uniform accuracy*, which allows only the best to get through Corbin — to you.

Look to Corbin Screw Corporation for your requirements in Corbin-Phillips and Corbin Slotted Wood Screws, Machine Screws, Hardened Sheet Metal Screws, Self-Tapping Machine Screws, Stove Bolts. Also Steel Drive Screws, Lag Screws, Cap Screws, Set Screws, Hex Semi-Finished Nuts, Machine Screw Nuts, Escutcheon Pins and Chain.

We manufacture Aircraft Screws and Nuts to government specifications.

See your Distributor — also complete stocks at Chicago, New York and New Britain . . . and sales representatives who can "talk shop."

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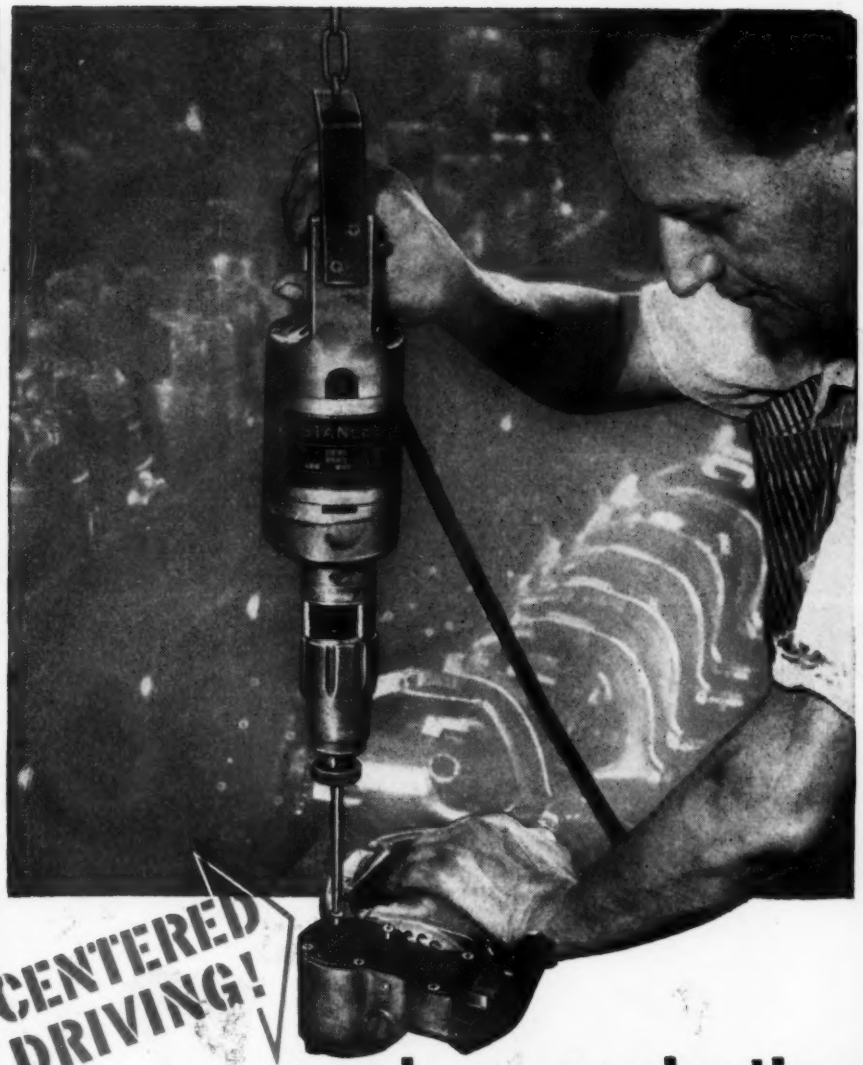
S-11



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Anything fastened with screws can be fastened faster, better, more economically with Corbin-Phillips Screws. Because the strong Phillips Recessed Head grips the driver in a four-point steel "center" that cannot slip. . . . Use Corbin-Phillips *Centered* Driving to speed production *safely*.

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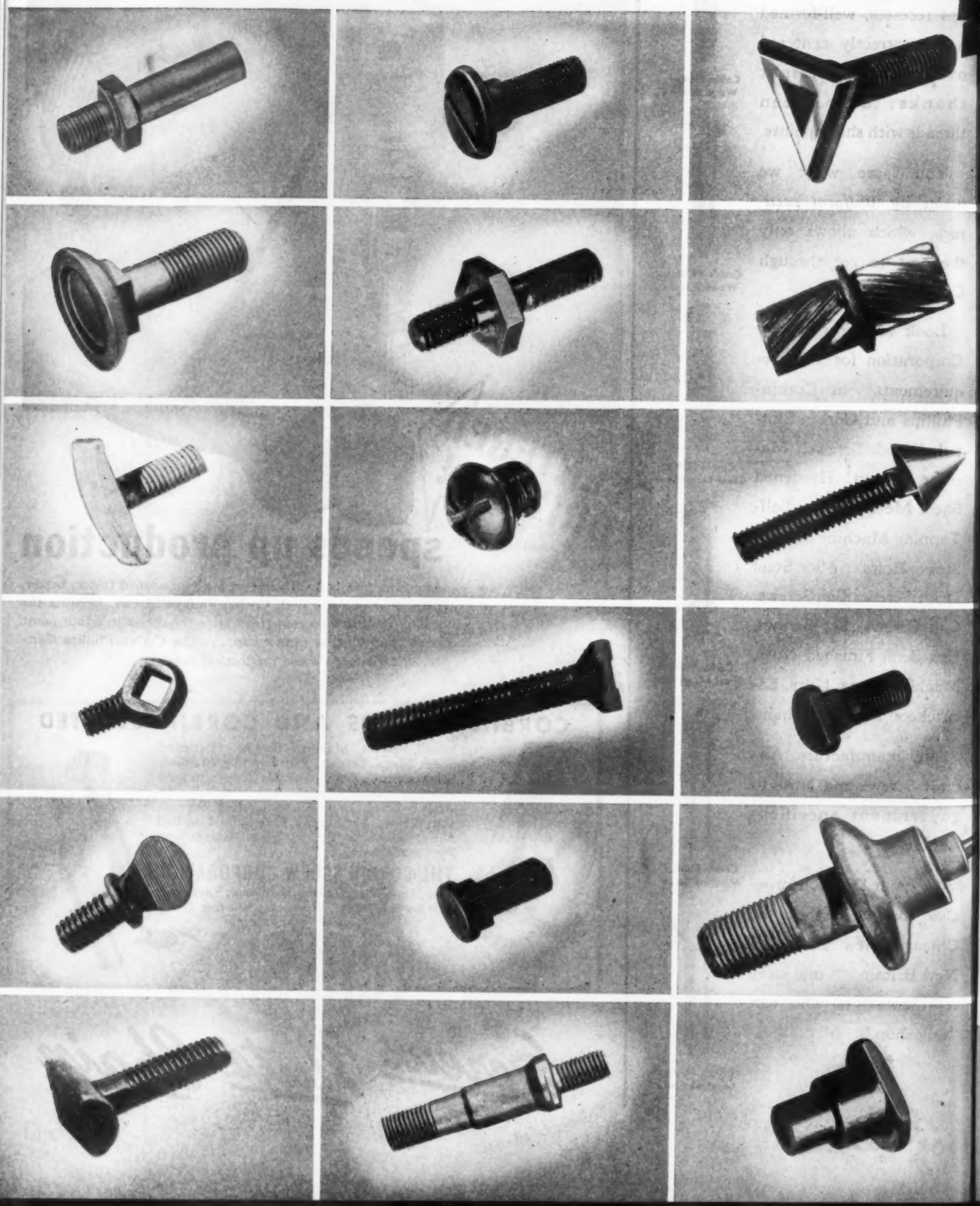

WE CAN MAKE IT STRONGER FOR YOU ..AND QUICKER..ON BOLT-MAKING MACHINERY...AND AT A SAVING!

Out of the thousands of "special" headed and threaded parts we have made in the past few years, this assortment of "special" cold-worked parts has been selected for your study. Among these products are some that have no resemblance to bolts and nuts, yet are made on bolt-making machinery. Some of them were produced on automatic screw machines, and most required second operations. Some even required assembly. All were eventually redesigned for production on bolt-making machines.

There are some important advantages gained by producing these parts by hot or cold forging on upsetting machines. In post-war production, you may want to use the short-cuts they represent to keep down your costs and obtain greater strength and accuracy.

In one fast, continuous operation at many times the speed of machining, Lamson & Sessions' equipment *cold upsets* the head (increases diameter); *cold extrudes* the portion of shank to be threaded (reduces diameter); and then *cold rolls* the thread form. These operations result in close, dense grain structure; smooth, strong surfaces, and accurate, uniform dimensions. Waste in chips and turnings is almost completely eliminated.

Because of the increase in strength gained from cold-working, parts may be designed lighter and smaller, and will therefore be produced at a lower cost for materials. Because cold-working effects an increase in strength, less expensive materials may be substituted, if desired, further reducing costs. Cold-working permits the production of irregular as well as regular shapes, and the use of metals which would be uneconomical to machine.

Here at Lamson & Sessions we use automatic screw machines for "second operation" work on parts *originated* on cold-headers, and we use bolt machinery for "second operation" work on parts *originated* on automatic screw machines. This versatility permits us to choose the best combination of methods to obtain the lowest costs. Lamson & Sessions produces large quantities of ground parts held to exceedingly close tolerances, and a variety of precision plated finishes are available.

The best way to conserve manpower and materials is to use a *standard product* if you can—and there are many to select from when you design or re-design. And then if you have a part which might be produced by upsetting more efficiently than it can be machined, call in a Lamson engineer to talk it over. *If we can make it* on *bolt-making machinery,* we can make it better, faster than *it can be made by any other method.*

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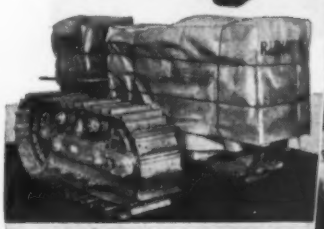
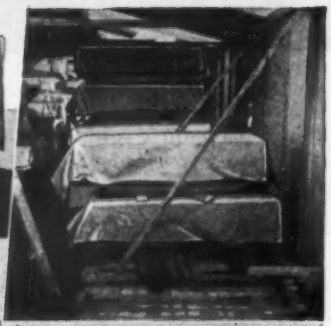
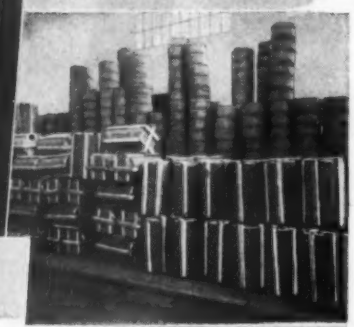


Fibreen keeps dirt and moisture from the motor of this powerful tractor.



Temporary emergency storage shelters are made with *Fibreen* on 2" x 4" frame.

Steel sheets wrapped with *Fibreen* are shipped safely in open cars.



Felt hats, wrapped with *Fibreen*, are protected from dirt and dampness.

Crates made with *Fibreen* often replace solid boxes, with resultant savings in packaging and shipping costs.

Send for a "working" sample of *Fibreen*. Our knowledge is at your service.

It's the All-Purpose Paper

Felt hats or tractors — sheet steel or hairpins — excess machinery in storage — goods shipped in open cars or in rolls, crates or cases—all are protected from moisture and dirt by *Fibreen*. Make sure that *your* products have dependable *Fibreen* protection — to assure safety while in storage and to prevent losses and complaints due to exposure in transit.

Keep a few rolls of *Fibreen* in your shipping room. It's pliable and tough!

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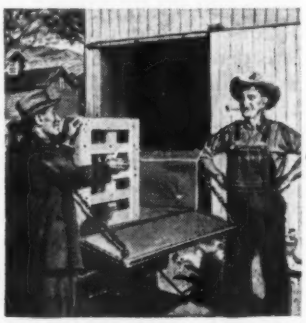
Gets Pump by Air Express: Dealer Saves Money, Cows get Water

WATER PUMP on Wisconsin dairy farm breaks down. The owner gives his local dealer a hurry-up call. Dealer promises quick delivery even though pump must come from Cleveland. (He has it in the morning by specifying Air Express.)

DEALER ABSORBS Air Express charges but, even so, he figures a saving of money — because the pump is a high-priced, slow-turn unit that he cannot afford to stock. (With Air Express the nation's inventory is within hours of your business.)



THOUSANDS of businessmen find this fastest delivery a real economy — *a real money-maker* — when a customer wants something not in stock. (Yes, with Air Express, you give high-speed service on high-priced items without cost of stocking.)

Specify Air Express — Low Cost for High Speed

25 lbs., for instance, travels more than 500 miles for $4.38, more than 1,000 miles for $8.75, more than 2,000 miles for $17.50, at a speed of three miles a minute — with cost including special pick-up and delivery in all U.S. cities and principal towns. Same-day delivery between many airport towns and cities. Direct service to scores of foreign countries. Rapid air-rail service to 23,000 off-airline points in the United States.

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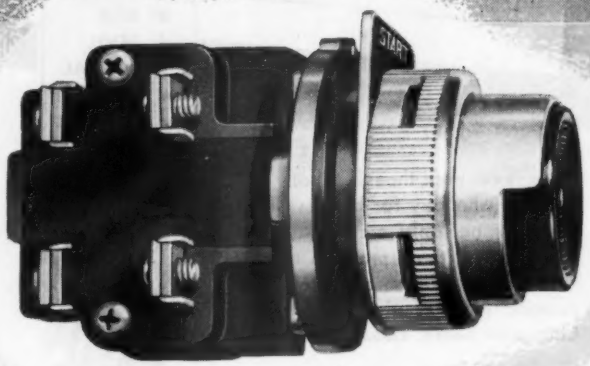

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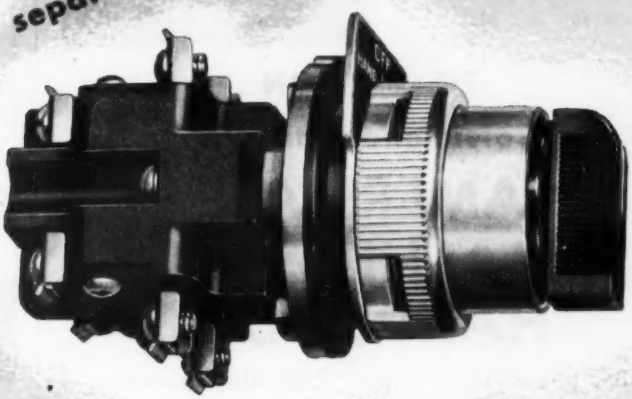
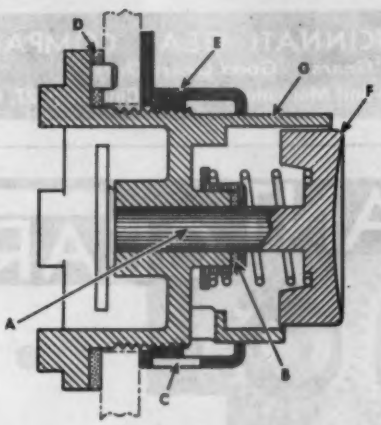
accessible terminals!
mounting in any position!
separate blocks and operators!





● Separate Operator makes possible an *oil-tight* construction without the use of a diaphragm. The long bearing (A), a spring-loaded seal (B), and drainage openings (C) prevent any leakage of oil, coolant or cutting compound through the Operator, regardless of mounting position. A gasket (D), evenly compressed by a threaded clamping ring (E), effectively seals the joint between the Operator and panel. The fade-proof, all-metal button (F) will stand rough usage and positive stops prevent damage to the Contact Block. The long bearing assures smooth operation over a long life. The relation of the button (F) and guard (G) is not affected by the thickness of panel in which the Operator is mounted.

Maximum Flexibility . . . Minimum Stock

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● See your nearby Square D Field Engineer for further details or write for Bulletin No. 202. Industrial Controller Division, 4041 North Richards Street, Milwaukee 12, Wisconsin.

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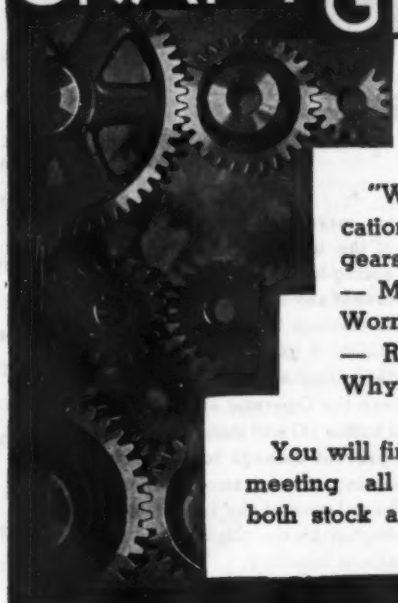

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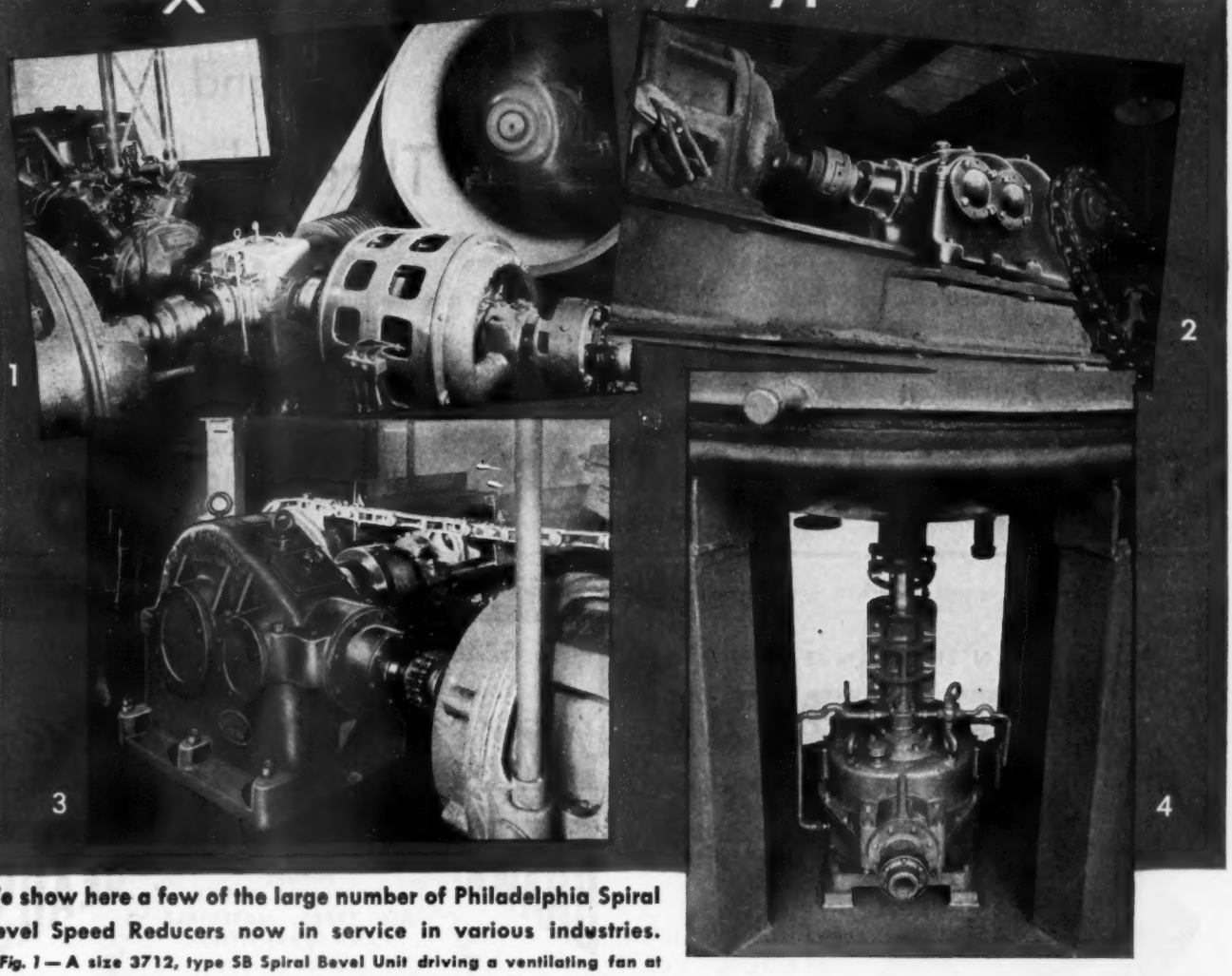

We show here a few of the large number of Philadelphia Spiral Bevel Speed Reducers now in service in various industries.

Fig. 1 — A size 3712, type SB Spiral Bevel Unit driving a ventilating fan at a coal mine. Ratio 1 to 1, 100 H. P. at 400 R. P. M. A double input shaft is connected with an engine for standby service.

Fig. 2 — Size 3609, type BLX Spiral Bevel Helical Reducer driving a conveyor. Ratio 57.7 to 1. Rated 9.5 H. P. at 870 R. P. M.

Fig. 3 — On a dock in the Ohio River, this size 3508, type BLT Spiral Bevel Helical Unit drives flight conveyors. 32 H. P. at 850 R. P. M.; ratio 10 to 1.

Fig. 4 — View of base of Vissolier, showing mounting of size 3509, type UBH reducer. This unit is driven by a 30 H. P. 1800 R. P. M. motor (not shown).

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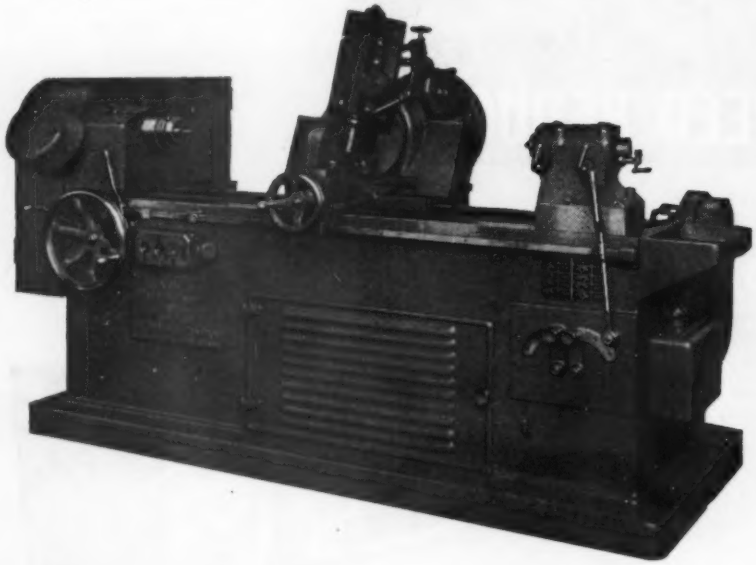

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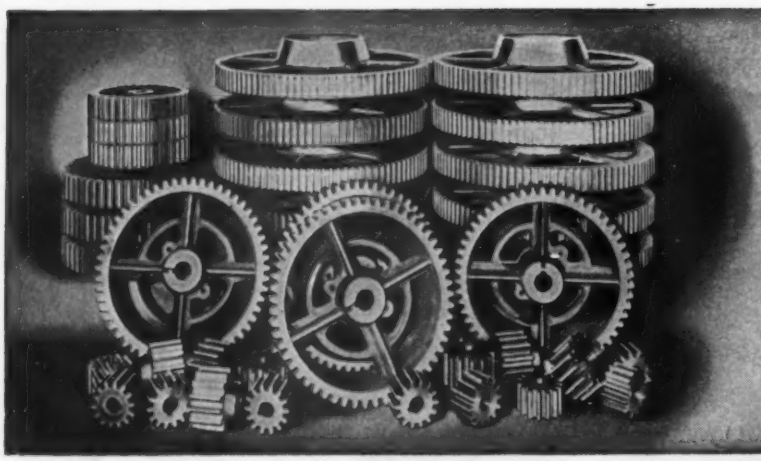

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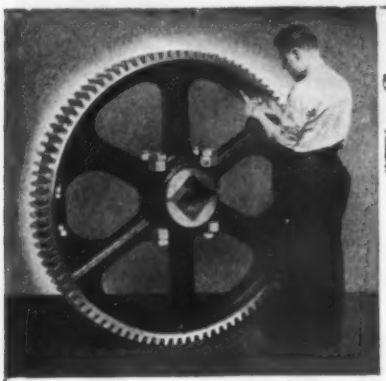

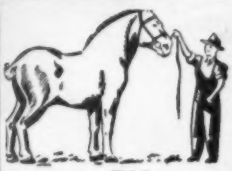

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Ability to handle those big, difficult, out-of-the-ordinary gear jobs with ease means that it's just plain horse sense that Stahl can go to town in meeting ordinary requirements. However, Stahl gives the same careful attention to all specifications for gears, large or small. Our modern facilities enable us to produce many types of gears and of any material—AT PRICES WHICH WILL INTEREST YOU.

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As manufacturers of high precision small gears for numerous vital controls used in this highly mechanized war, we are literally 'swamped'.

Therefore, under existing conditions, we are forced to minimize further commitments unless they have W.P.B. urgency support.

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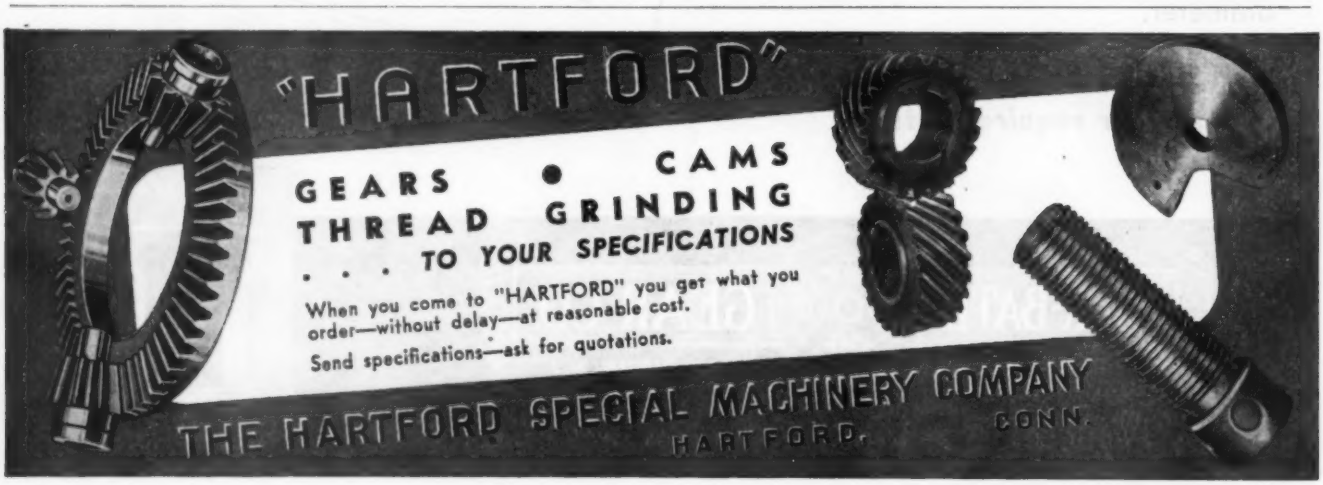
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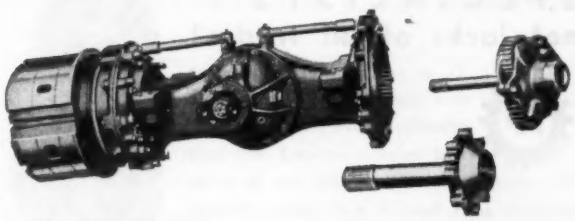
Euclids "MOVE MOUNTAINS" WITH THE HELP OF *Ohio Gears*



When there are literally mountains to be moved . . . earth, coal, rock, ore . . . for airports, dams, roads, quarries, mines or any tough off-the-road job, Bottom-dump Euclids get the call. So Euclids have to be rugged. Every part must stand up. The drive axle, an exclusive Euclid feature, must render continuous, trouble-free performance in every kind of off-the-highway service. That's why Euclid Road Machinery Company engineers employ Ohio Gears and shafts in the final drive. They've proved the accuracy, toughness and durability of Ohio Gears under every kind of test and field condition.

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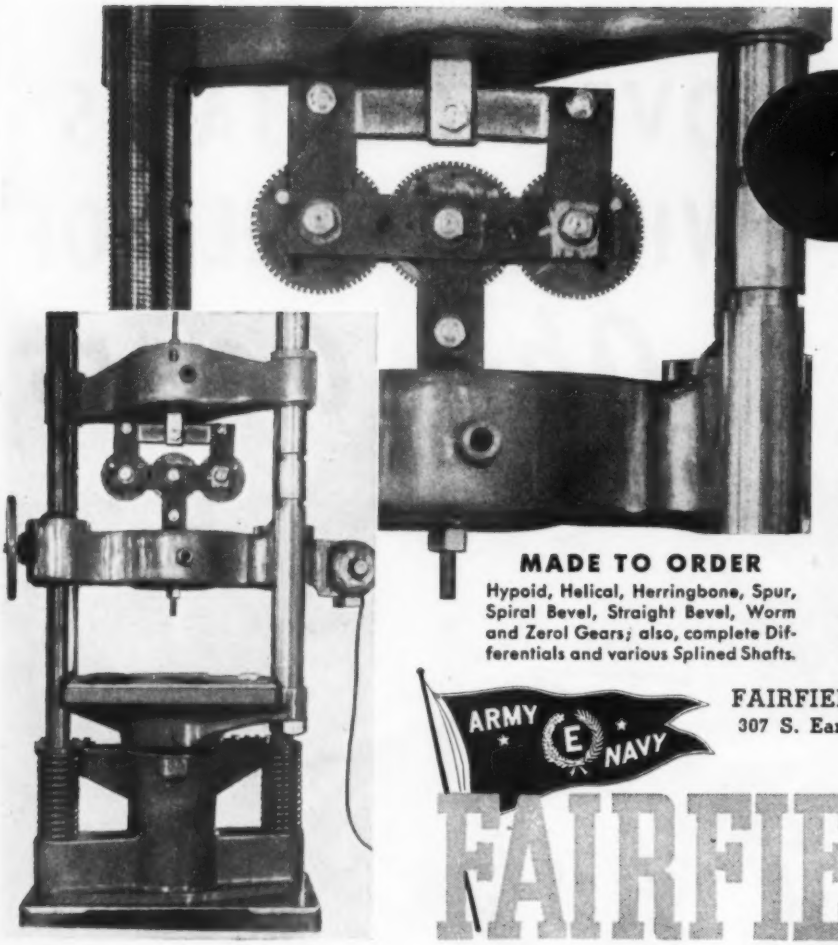

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You can judge gears by the standards set for their inspection.

At Fairfield's, the machine testing *static strength* uses three gears, the two outside gears being pulled up and the center gear down. All gears are accurately held on correct center distances and, by means of a bright light and a magnifying glass, the teeth are watched as the load increases steadily up to the breaking point. After a tooth failure, the gears are rotated and test repeated. The method is valuable in comparing the strength of various materials and methods of heat treating, and provides a basis for studying the effect of velocity on gear strength.

Gear processing service by Fairfield is supported by extensive, modern facilities and *25 years of experience.* Write for our brochure on gears.

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Hypoid, Helical, Herringbone, Spur, Spiral Bevel, Straight Bevel, Worm and Zerol Gears; also, complete Differentials and various Splined Shafts.

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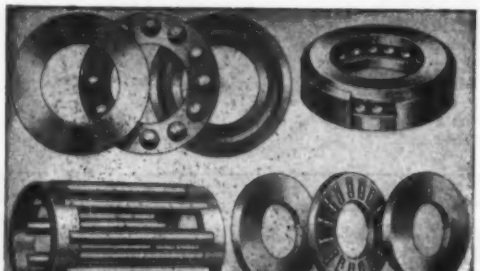

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BOSTON GEARS

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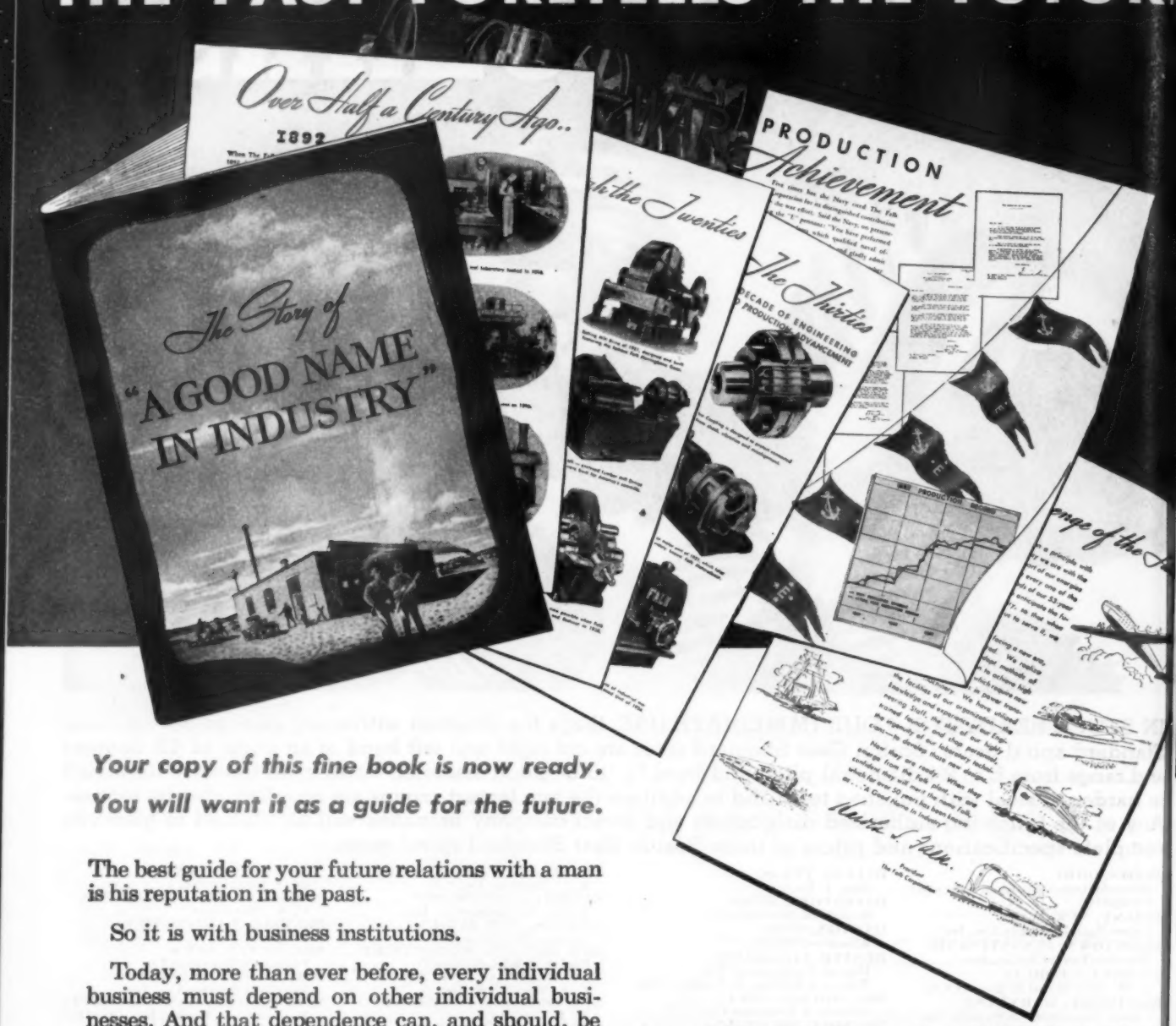

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The best guide for your future relations with a man is his reputation in the past.

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Bulletin 82 describes Cleco Riveting Hammers in detail. Ask for it!

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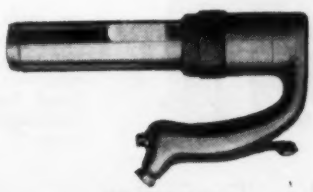
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Precision CENTERED EYE Bending

The DI-ACRO Bender makes perfectly centered eyes from rod or strip stock at high hourly production rates. Both eye and centering bend are formed with one operation. Any size eye may be formed within capacity of bender and ductile limits of material.

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DI-ACRO Precision Bending is accurate to .001" for duplicated parts. DI-ACRO Benders bend angle, channel, rod, tubing, wire, moulding, strip stock, etc. Machines are easily adjustable for simple, compound and reverse bends of varying radii.

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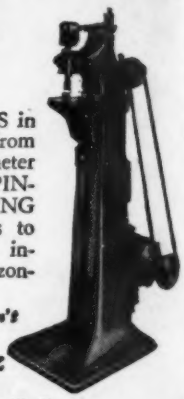

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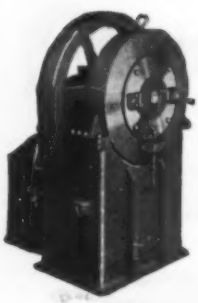

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ARMY E NAVY

THE PROBLEM was to get the edges to meet smoothly

As a matter of fact it would be hard to conceive of a trickier press problem in this respect. The time was 1905. But even then Presteel was cracking the hard ones. Incidentally, the substitution of stampings for forgings reduced the weight of a bicycle by about *sixty pounds.*

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essential to faster, better work in Tool and Die Shops.

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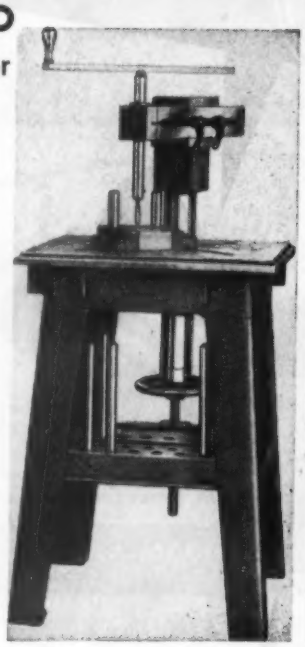
Universal Hand Tapper



This recently developed machine is a "natural" for tool and die shops because it absolutely insures accurately tapped holes and prevents tap breakage. No setting up is required and work is handled quickly and easily.

Holes can be tapped or reamed in any position on the table. Two sizes of spindles provide for a range of tap sizes from No. 5 to 1" diameter.

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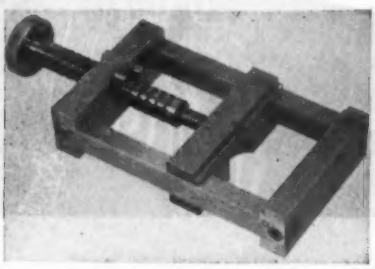

Handy and light in weight — with large, opening capacity. A precision tool for jig borers, surface grinders and accurate tool room purposes. All parts are hardened, with surfaces and jaws ground at right angles and parallel. Step jaws permit tight gripping for drilling holes close to edge of work without the use of parallels. One jaw has a Vee for holding round parts or punches. Quick acting grooved spindle permits fast adjustment. Locking latch engages groove in spindle and turn of Knurled wheel operates telescoping screw which tightens jaw.

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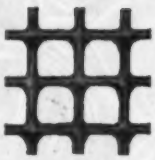

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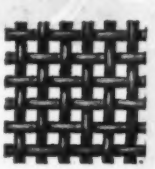
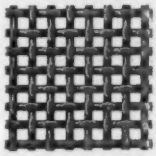
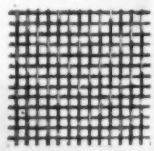
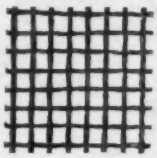
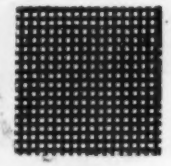
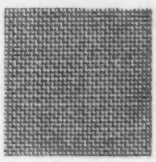












We will follow your specifications and blue-prints exactly as your production engineers have prepared them—or we will submit suggestions for your approval.

"Perfect" alloys and metals	*"Perfect" Wire Cloth weaves*	*"Perfect" Wire Cloth processing*	*"Perfect" Wire Cloth products*
Super-Loy	Arch-Crimp	Bending	Baskets
Steel	Coiled	Binding	Circles
Galvanized	Double-Crimp	Brazing	Cones
Tinned	Double-Fill	Calendering	Crates
Stainless Steels	Dutch	Clinching	Cylinders
Nickel-Chromium alloys	Filter	Cutting	Discs
Aluminum	Flat-Top	Dipping	Forms
Brass High Low	Herringbone-Twill	Dishing	Leaves
Bronze Commercial Phosphor	Intermediate-Crimp	Flanging	Lengths
Copper	Rek-Tang	Flattening	Panels
Monel Metal	Selvage-Edge	Forming	Pieces
Nickel	Straight-Warp	Framing	Racks
Any special alloys available in rod or wire form	Stranded	Galvanizing	Ribbons
	Sta-Tru	Painting	Rolls
	Triple-Warp	Shearing	Sections
	Twilled	Slitting	Segments
	Twisted-Fill	Trimming	Spacers
	Twisted-Warp	Arc-Welding	Strips
		Gas-Welding	Template Shapes
		Spot-Welding	Trays

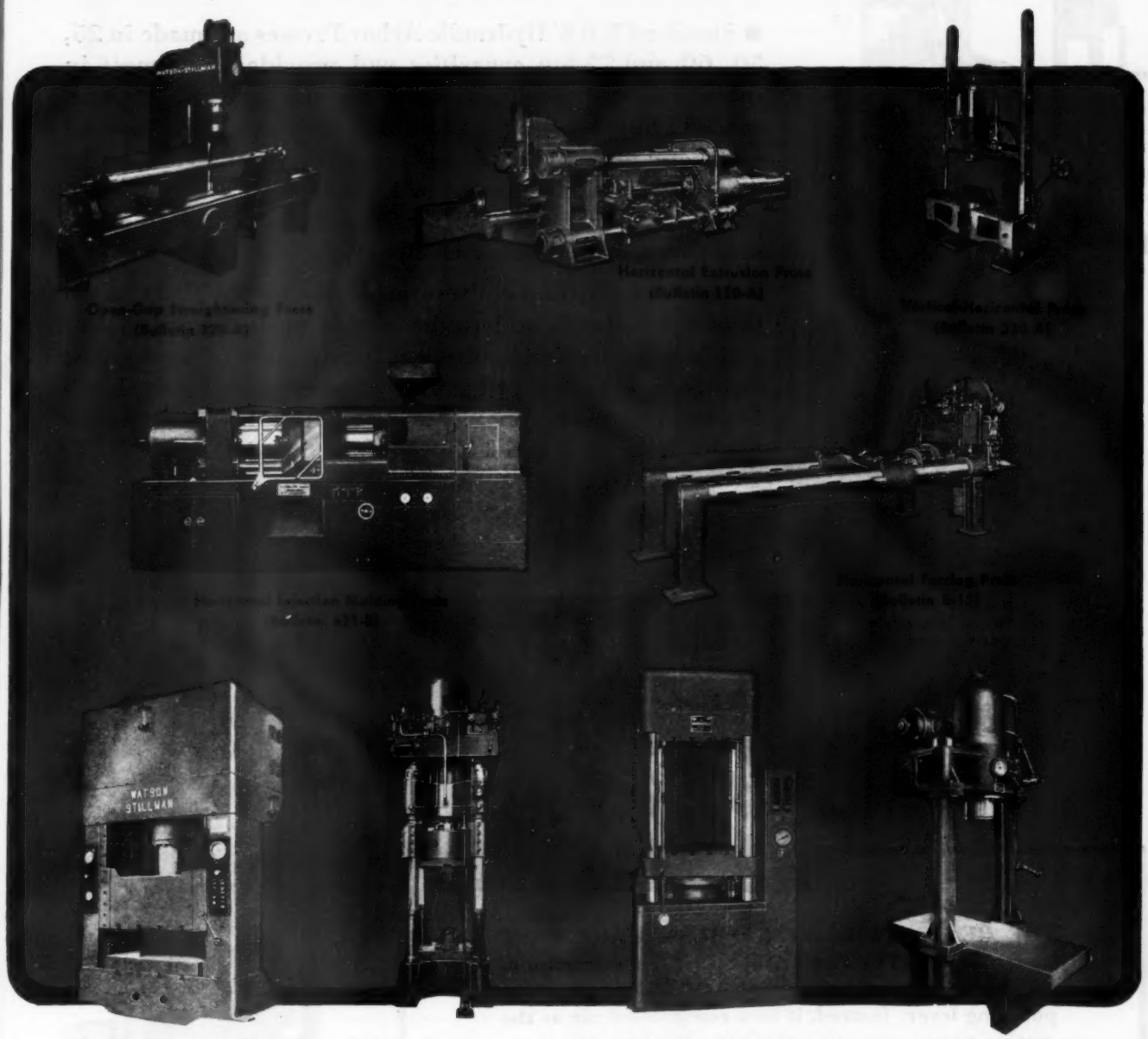
The LUDLOW-SAYLOR WIRE COMPANY
Newstead Avenue & Wabash Railroad
ST. LOUIS 10, MO.

HYDRAULIC PRESSES FOR EVERY INDUSTRY

Watson-Stillman builds a comprehensive line of hydraulic presses and equipment that meets the many and varied requirements of railroads, aircraft, automotive, ceramic, plastic, ship yards, metal working, chemical and processing plants and practically all other major industries.

W-S presses include types for assembling, baling, bending, briquetting, cable covering, coining, dehydrating, embossing, extruding, flanging, forcing, ceramic and plastic molding, straightening, stamping, testing, and vulcanizing, forming, drawing, blanking, etc. Watson-Stillman also builds accumulators, intensifiers, pumps, forged steel valves and fittings and other items necessary for the installation and efficient operation of complete hydraulic systems.

The presses shown here are but a few of the many types and sizes produced by Watson-Stillman. For more detailed information, write for bulletin 110-A covering a wide variety of hydraulic equipment.



Single-Action Forming Press (Bulletin 110-A)

Double-Action Forging Press (Bulletin 110-A)

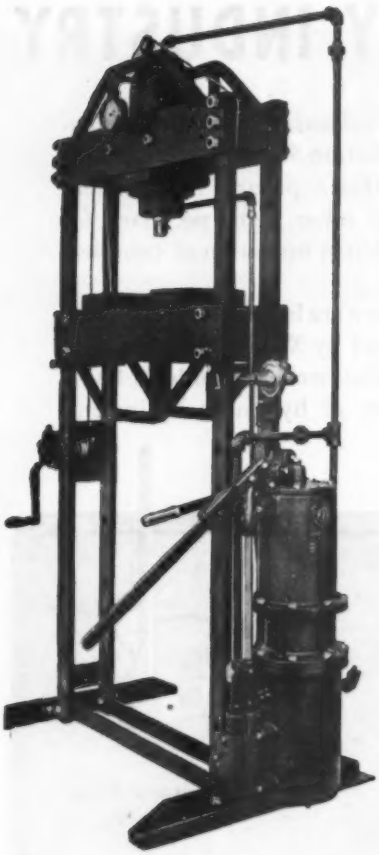
Compression Molding Press (Bulletin 641-A)

Vertical Bushing Press (Bulletin 520-A)

THE WATSON-STILLMAN COMPANY

FACTORY AND MAIN OFFICE • ROSELLE, NEW JERSEY, U.S.A.

DESIGNERS AND MANUFACTURERS OF HYDRAULIC EQUIPMENT, VALVES AND FORGED STEEL FITTINGS



"They can do e

THAT'S THE WAY ONE PRODUCTION MAN EXPRESSES HIS OPINION OF

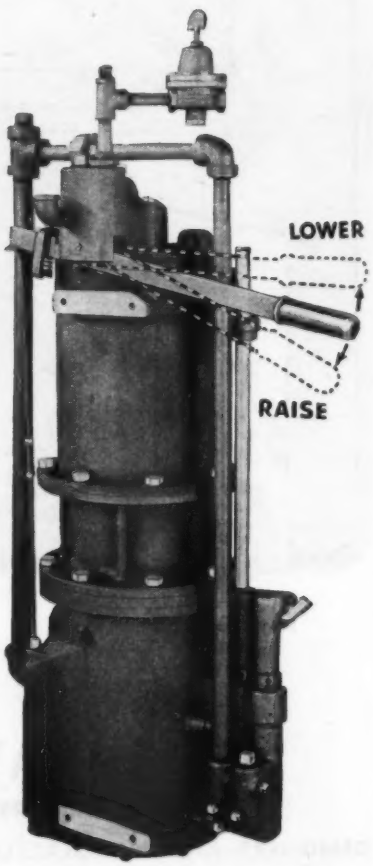
KRW HYDRAULIC PRESSES

● Standard KRW Hydraulic Arbor Presses are made in 25, 50, 60 and 75-ton capacities and provide the utmost in speed, efficiency and versatility. For unusual applications, special presses—at slight additional cost—can be engineered to exactly fit any special problem. Any KRW Press can be equipped for Hand, Air-Oil or Electric-Oil operation. Many special presses combine these methods of operation in order to provide greater efficiency.

Bring your Hydraulic Press problems to KRW. In more than one instance we have been able to design, build and ship a specially-designed press in a matter of weeks that did the job better, faster and cheaper than costly, hard-to-get equipment. Write for descriptive Press Bulletin. K. R. Wilson, Dept. 11, 215 Main St., Buffalo 3, N. Y.

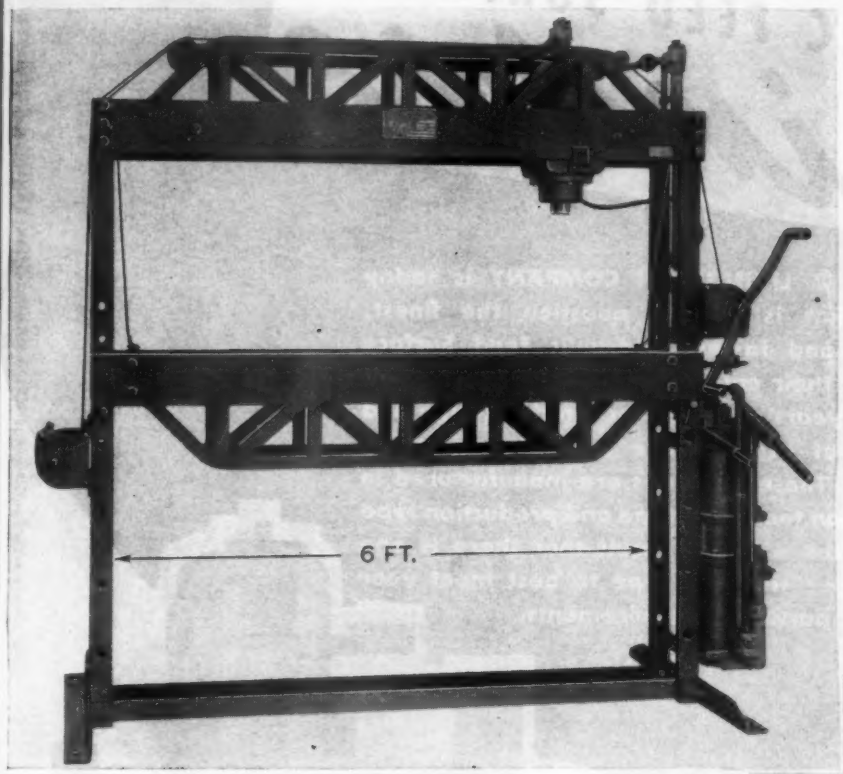
75-ton KRW Press equipped with patented Speedi-Booster and Finger-tip control.

THE KRW Speedi-Booster



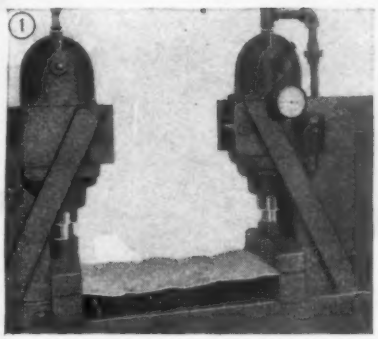
THE REASON WHY KRW PRESSES ARE FAST AND ACCURATE. The KRW Speedi-Booster eliminates the need for the conventional Capstan wheel or pumping lever. Instead, it uses compressed air as the motive power operating the ram. Because the compressed air is controllable through a pressure regulator, any desired tonnage pressure at the ram can be obtained and duplicated. Ram movement (up, down or stop) is instantly controlled with the slightest finger-tip movement of the lever.

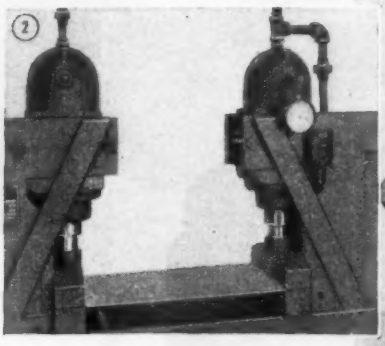
...everything but cook"



This special adaptation was built to STRAIGHTEN ARMOR PLATE. The entire ram head mechanism slides the full width of the head frame so ram can be positioned over a "high spot" on the plate. Distance between uprights, 6 feet. Air-Oil and Hand operated.

Adapted as a SHEET METAL STRAIGHTENER. This unit consists of three heads on a special frame. The two upright heads grip the metal sheet. Horizontal head quickly removes kinks by stretching. This unit combines Hand, Air and Electric-Oil operation. (Any one can be used independently).





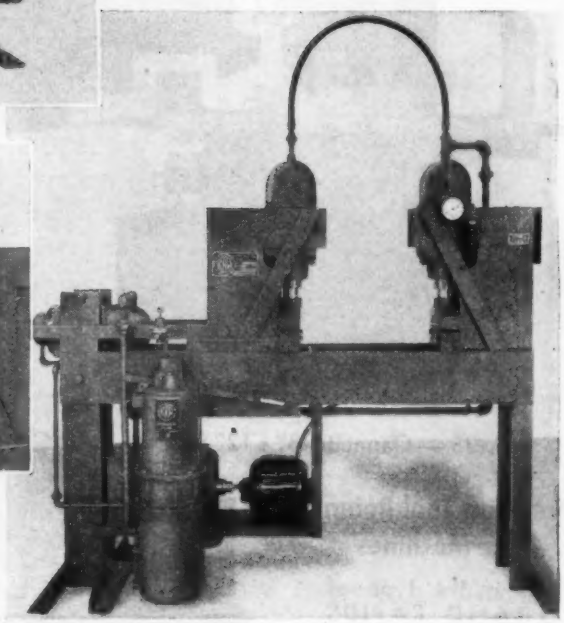


Illustration No. 1 shows "kinked" sheet metal as it comes from the rollers, gripped by the two vertical heads. Illustration No. 2 shows the sheet after being "stretched" flat by pulling pressure of the horizontal head.

AVAILABLE TONNAGE PRESSURES
25-50-60 TON PRESSES

AIR PRESSURE	7" AIR CYLINDER		9" AIR CYLINDER	
100 TO 200 POUNDS	2" Oil Cylinder	1¾" Oil Cylinder	2" Oil Cylinder	1¾" Oil Cylinder
	10 to 22 Tons	14 to 29 Tons	17 to 35 Tons	23 to 47 Tons

75 TON PRESS

AIR PRESSURE	9" AIR CYLINDER	
100 TO 200 POUNDS	2" Oil Cylinder	1¾" Oil Cylinder
	25 to 51 Tons	33 to 68 Tons

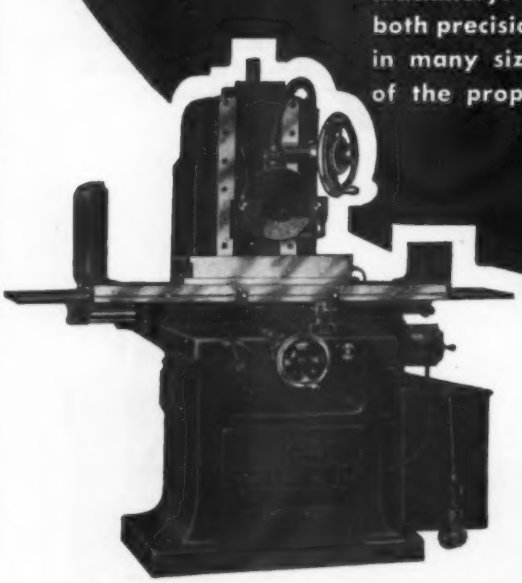
Write Today for the
KRW HYDRAULIC PRESS CATALOG

SINCE 1918 KRW SYMBOL OF DEPENDABILITY

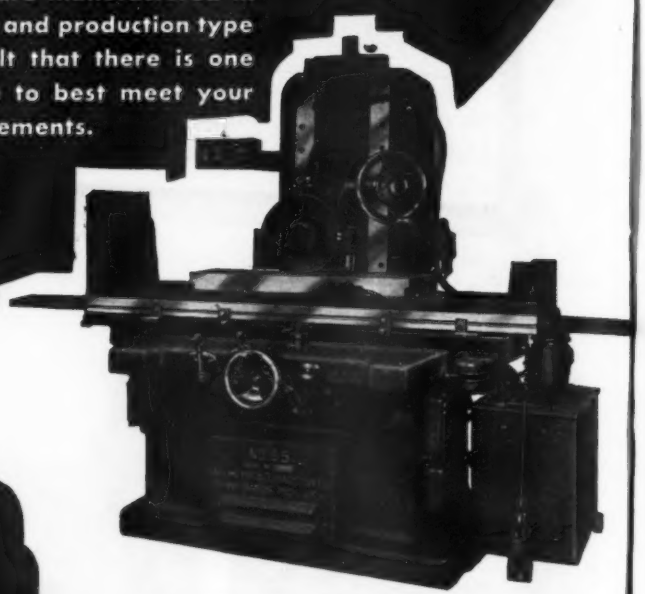
K. R. WILSON
BUFFALO 3, NEW YORK

GRAND RAPIDS
HYDRAULIC FEED SURFACE
Grinders

GALLMEYER & LIVINGSTON COMPANY is today building what is without question the finest, smoothest, and fastest Hydraulic Feed Surface Grinders of their entire career — a direct result of over 35 years of experience in the design and production of high grade precision grinding machinery. These machines are manufactured in both precision tool room type and production type in many sizes with the result that there is one of the proper size and type to best meet your particular requirements.



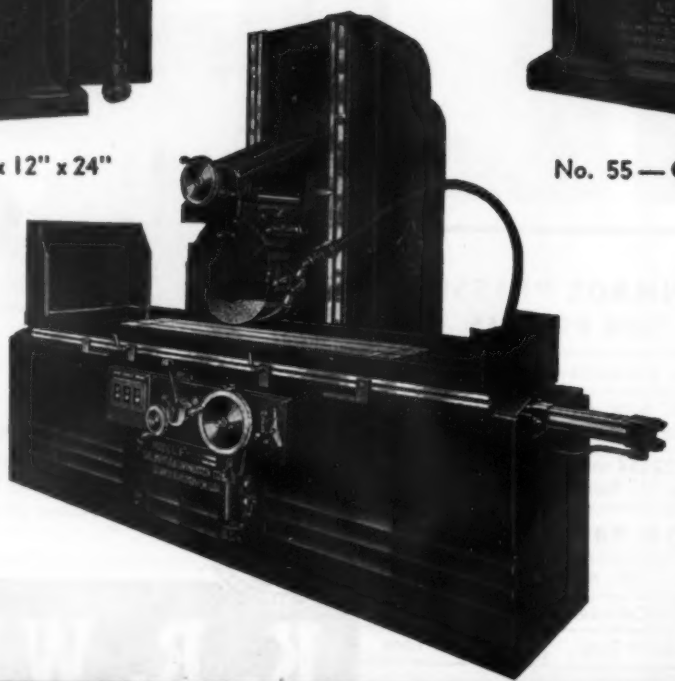
No. 35 — Capacity 8" x 12" x 24"



No. 55 — Capacity 12" x 17" x 36"

Precision Tool Room Type Machines

This is the type of GRAND RAPIDS Hydraulic Feed Surface Grinder on which one prominent machine tool builder obtains a 5 micro inch finish operating machine at 125 feet per minute. They are illustrated and described in bulletin GL-100.



Production Machines

GRAND RAPIDS Production Type Hydraulic Feed Surface Grinders manufactured by the GALLMEYER & LIVINGSTON COMPANY are designated as Model F and Model A and feature the use of wide faced wheel and cross traveling head. GRAND RAPIDS Production Type Hydraulic Feed Surface Grinders are illustrated and described in bulletin GL-4-1-43. Write for your copy today.

GALLMEYER & LIVINGSTON CO.

330 STRAIGHT AVE. S.W.

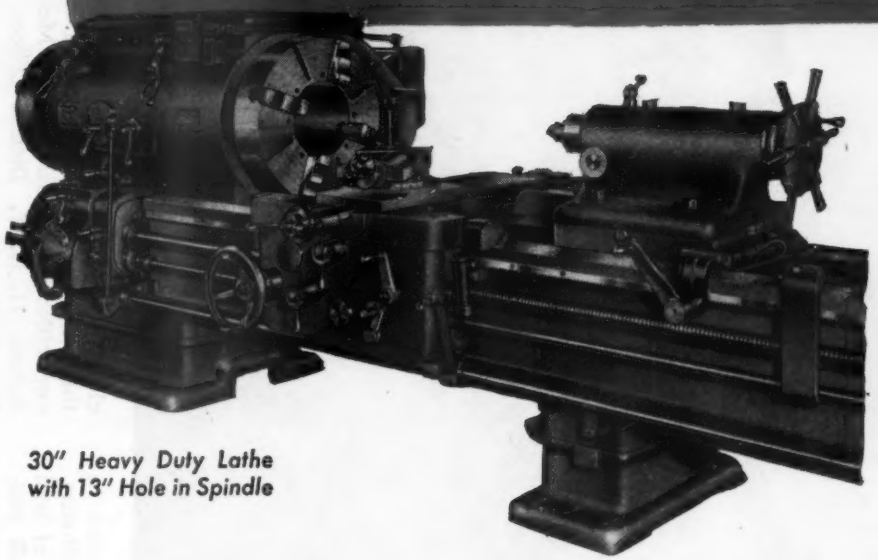
GRAND RAPIDS, MICHIGAN

SAVE TIME-CUT COSTS!

DO IMPORTANT MACHINING JOBS IN 1/2 TO 1/7 THE TIME! . . ON A

HYDRATROL LATHE

(Large Hollow Spindle Type)



30" Heavy Duty Lathe with 13" Hole in Spindle

5 sizes-18" to 36"

Small, 18" up to 7-1/4" Hole
Medium, 24" up to 12" Hole
Large, 27" up to 13" Hole
Large, 30" up to 14" Hole
Large, 36" up to 16-1/2" Hole

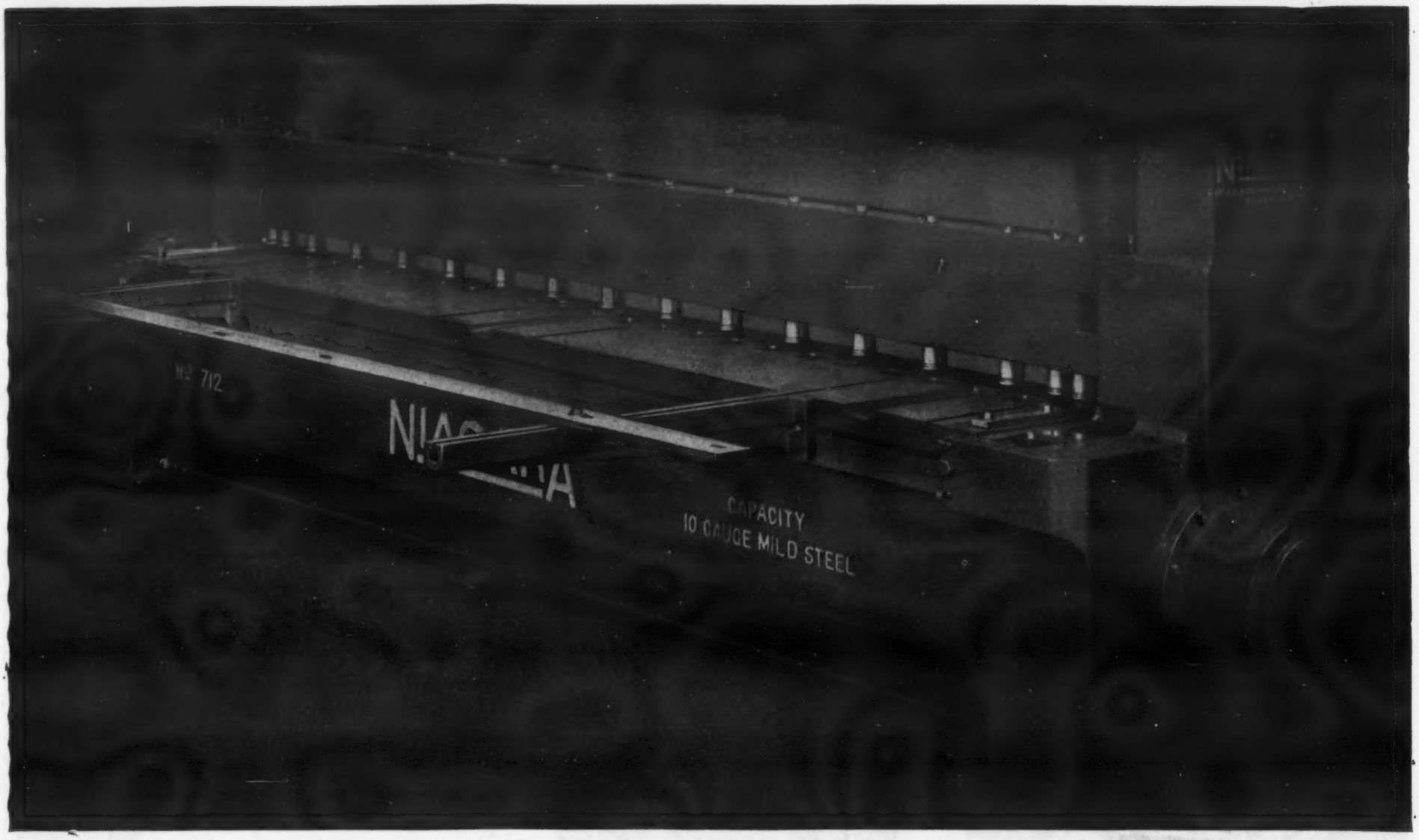
(Standard Type lathes, 16" to 36")

IN a number of big war plants, on HYDRATROL LATHES, important operations are being performed in 1/2 to 1/7 the time of previous operations. In one plant, HYDRATROL LATHES are saving 15,000 man hours per month!

Maybe YOU, too, can "do it better" on a HYDRATROL LATHE (Large Hollow Spindle Type). Maybe you, too, can achieve faster production, better work, lower costs. Why not let us show you what a HYDRATROL LATHE could do in your plant?

Lehmann MACHINE COMPANY

CHOUTEAU AT GRAND ★ ST. LOUIS 3, MISSOURI



More production per man hour is being obtained in war plants using Niagara Power Squaring Shears. Convenient operation, quick, accurate setting of ball bearing, self-measuring parallel back gage, full visibility of cutting line, instant-acting Niagara sleeve clutch and complete accessibility at rear are some of their modern features. Built in a complete range of capacities and sizes. Niagara Machine & Tool Works, Buffalo 11, N. Y. District Offices: Detroit, Cleveland, New York.

Shear knives available for cutting alloy and special steels. Let us know what you desire to cut. Prompt delivery on spare knives for Niagara Squaring Shears. Also factory regrinding service by the same skilled men who grind new Niagara knives.

BUY UNITED STATES WAR BONDS AND STAMPS

BUY UNITED STATES WAR BONDS AND STAMPS

YESTERDAY . . .
TODAY . . .
TOMORROW . . .

BAUSH

SPEEDS PRODUCTION

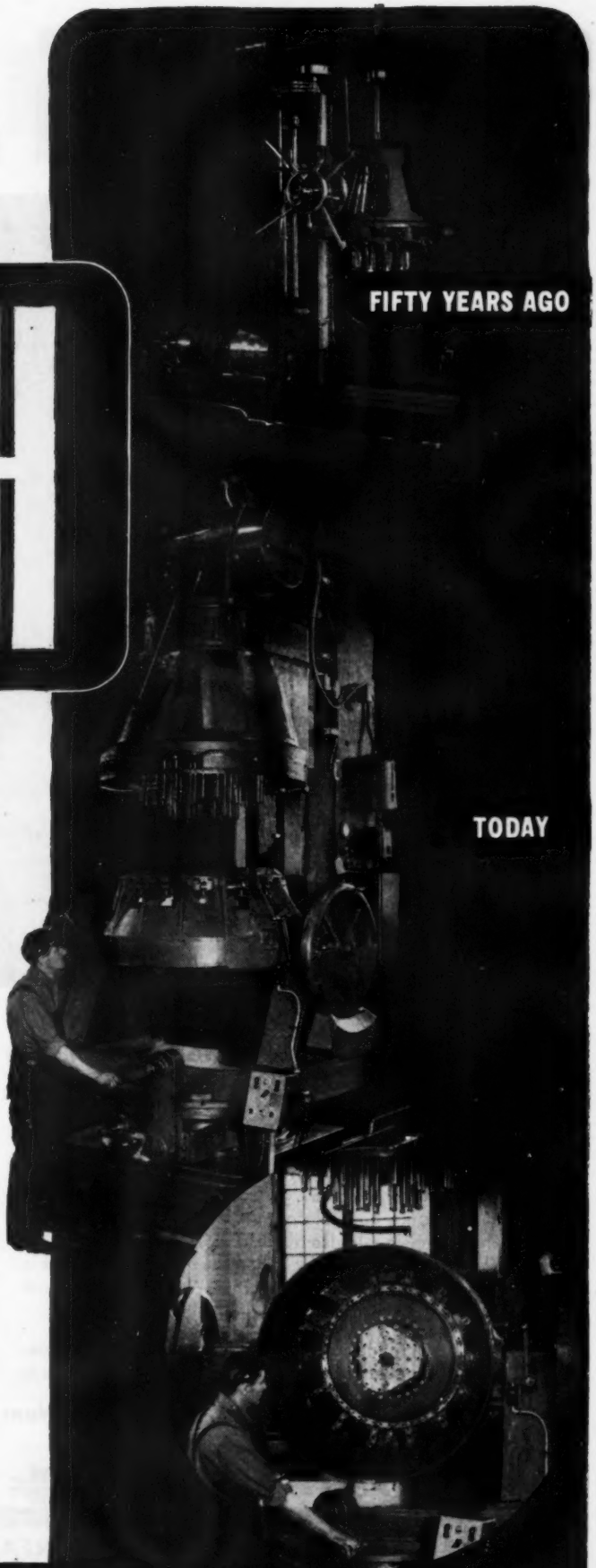
Whether it be drilling, boring, reaming or tapping—Baush Machine Tools meet every need in the evergrowing battle of economical production.

Every manufacturer wants profits. Modern machines designed for specific jobs to give precision, speed, economy and ease of operation are the answer.

The Multiple Spindle Drill illustrated is just one of many special units designed and built by Baush. It is working proof that 50 years of experience can, and will, show you production line profits.

Our engineers will gladly help you solve your problems. Write us—call us—wire us—we're ready to help.

Drilling 70 holes on 3 various bolt circles with Baush W-7 Hydraulic Multiple Spindle Drill. 36" diameter round head is furnished with 35 slip sleeve spindles with nose adjustment, master-bored cluster plate and Texrope drive. 50" ballbearing index table with geared hand crank indexing has trunnion type fixture which rotates 180° for first 35 hole drilling—table is then rotated 1/7 turn and final 35 holes drilled.



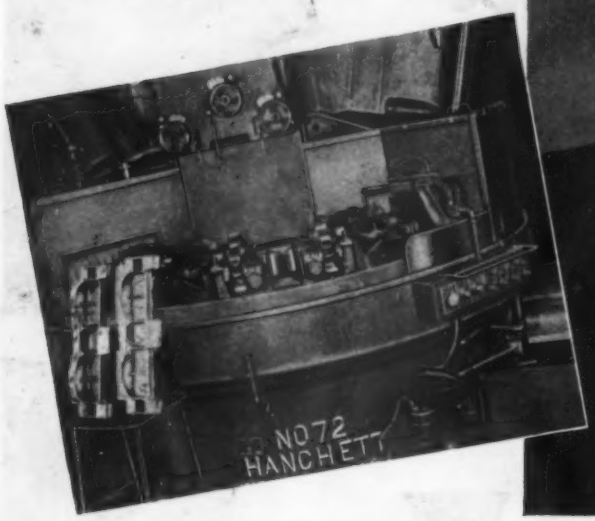
BAUSH MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

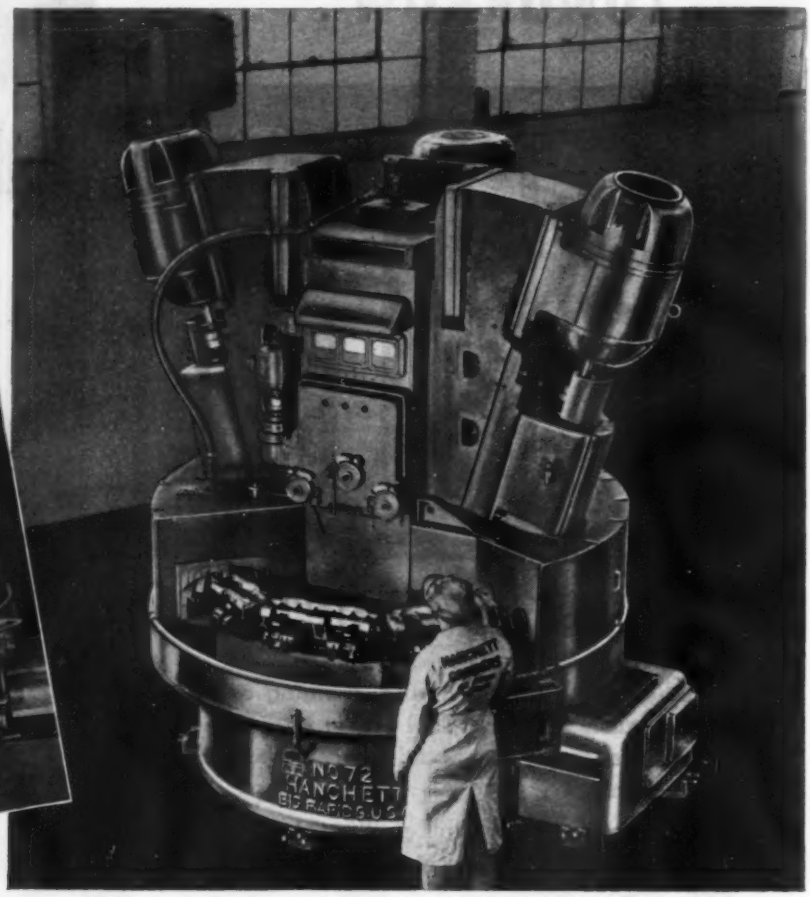
GRINDING SURFACE AS YOU WANT IT..

on a HANCHETT AUTOMATIC

Rotary table adapting fixtures for the grinding of steel tank parts. Parts are shown — left, after grinding — right, before grinding.

Where space is at a premium and high precision production a must, the Hanchett Automatic is your only answer.





More Precision Finished Pieces Per Hour • Less Non-Productive Floor Space . . . with the Hanchett No. 72 or No. 100 Grinder

Within a floor space area of only 9′ x 9′, there is a combined machine of entirely new design with three, four, or five vertical grinding heads compactly mounted on a central column. The work "rolls" off within precision limits of .0005. A rotary work table (72" diameter or 100" diameter) carries suitable fixtures or magnetic chucks. In one pass the work receives roughing, semi- and finish grinding.

A special application of the Hanchett No. 72 Grinder is illustrated above. Two of the grinding heads have extreme angularity from the vertical to grind off the angular "risers". The third head is vertical and grinds another set of "risers" in a straight plane. These steel castings come directly from the foundry and are ground at a rate of 250 to 300 pieces per hour—stock removal, approximately .500.

Hanchett's experienced engineers will show you how one or more of these Hanchett Automatics can be adapted to your production line to decrease manufacturing costs—and there's no obligation.

For further details contact your nearest Hanchett dealer, or write direct for Bulletin

HANCHETT GRINDERS — BIG RAPIDS MICHIGAN

IF IT'S A FLAT SURFACE—THERE'S A HANCHETT TO GRIND IT

HANCHETT MANUFACTURING CO.
BIG RAPIDS, MICHIGAN U.S.A.

Do it with DALZEN

Left: Dalzen taps, in U. S., Metric, Whitworth, and Special forms are precision ground of hardened high speed steel in a complete size range. TUNGSTEN CARBIDE TAPS — EITHER SOLID OR INSERT—A SPECIALTY.

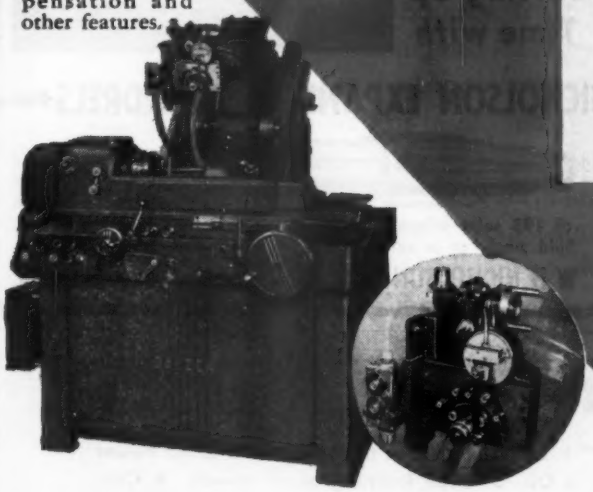
Left: High speed ground thread milling cutters, scientifically heat treated for longer cutting life

Dalzen manufactures an extensive line of precision cutting tools, parts, thread grinding and special machines — engineered for maximum efficiency and economical operation. Each is the result of years of experience on the part of designers and craftsmen. These are reasons why, all over the United States and in many foreign countries, master mechanics who have used and worked with Dalzen-made machines and tools say, "You can do it better with Dalzen." Write for details on how Dalzen can "do it better" for you.

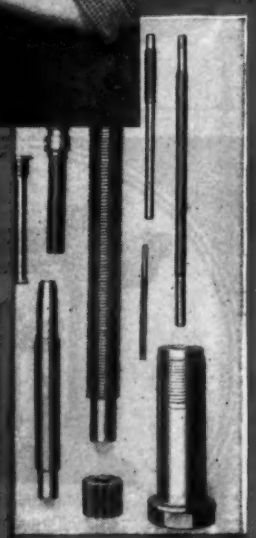
Below: Dalzen "2-in-1" combines a dependable, accurate center lapping machine with a sturdy drill press. Saves on equipment costs, floor space.

Below: No. 5 *Electronic* Thread Grinder. Easy to operate. High production efficiency and accuracy by controlled wheel speed, motor driven dresser, automatic compensation and other features.

Right: No. 2 Thread Grinder. Compact, upright design saves floor space. Simple to operate. Low first and maintenance cost. Ideal for short or production runs.



Right: Threaded parts are ground to close tolerances exactly to your specifications. Rigid inspection standards assure a uniform fine finish. Jobs requiring rolled or cut threads are also handled.



DALZEN

TOOL AND MANUFACTURING CO.

12255 EAST EIGHT MILE ROAD • DETROIT 5, MICH.

PISTON PINS TAPER REAMED 6 PER MINUTE

This machine is entirely automatic with the centrally located hydraulic holding fixture, operated by a separate motor, inter-locked with the Hoefer Units, with the following work cycle:

1—Jaws open, permitting pin to enter from chute.

2—The jaws close automatically, starting work feed.

3—The two horizontal spindles approach the work at rapid traverse, changing to work feed as reaming begins.

4—Spindles withdraw at rapid traverse.

5—Jaws open, permitting finished piece to drop out.

The operator's only duty is to keep the work chute filled.

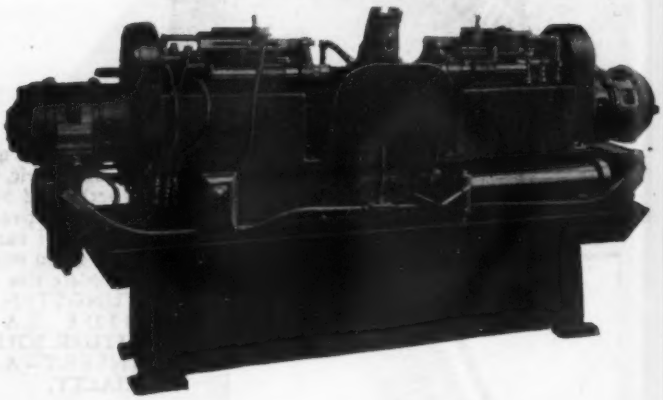
Fully automatic Double End Machine containing two 3 h. p. Hoefer Hydraulic Units and a special hydraulic fixture. Taper reams six piston pins per minute, both ends.

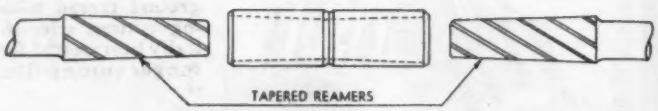
The operator fills hopper and machine handles pieces automatically. The hopper is in full operation for 10 minutes machining 60 pins before reload is necessary.

Pins are $1\frac{1}{16}$ inches O. D. by $3\frac{5}{8}$ inches long.

Safety devices prevent collision of reamers.

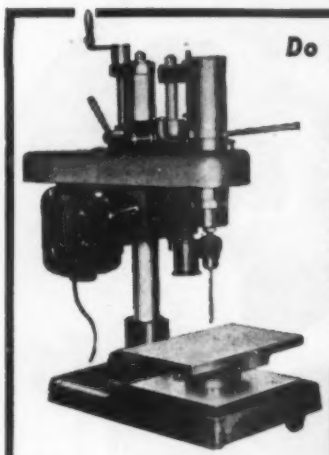
Let us give you more details on this equipment—its immediate application to today's needs and its advantages for post war production.





Hoefer's Whole Business is Holes . . . .

HOEFER MFG. CO. *Freeport, Ill.*



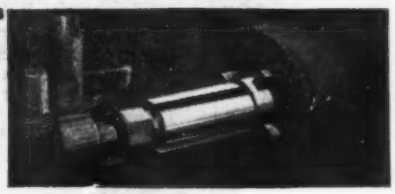
Do your sensitive drilling on a

MAXI-JR-E

● Here is a high production unit for small holes from .004" to .250" diameter. Sturdy — smooth — fast —it is a self contained unit with 8 inch vertical adjustment on column. Drilling unit overhang from center of chuck to column 5". Vertical capacity 10". Available in spindle speeds from 750 to 12,000 r.p.m. Write for bulletin.

The Hamilton Tool Co.
HAMILTON OHIO

SAVE *Setting-Up Time with*

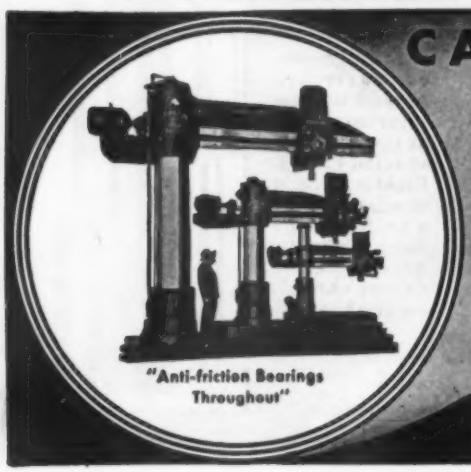


★ ★ ★ ★ ★

NICHOLSON EXPANDING MANDRELS

Set of 19 of these economy, precision tools does the work of 193 solid arbors. Hardened tool steel. 2 types, all sizes. Sold singly or in sets. Prompt delivery. Bulletin 1043.

W. H. NICHOLSON & CO., 114 Oregon St., Wilkes-Barre, Pa.



CARLTON RADIAL DRILL

FEATURES — 1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

The **CARLTON**
MACHINE TOOL COMPANY
CINCINNATI, OHIO, U. S. A.

ARMY E NAVY

Logan A NAME TO REMEMBER WHEN YOU THINK OF **BETTER** LATHES

BUILT BY MEN WHO VALUE PRECISION

The men who build Logan Lathes place a premium on precision. From their own daily experience in building precision machines they know how vital accuracy is. Not only Logan executives and engineers, but also the men in the shops, share in an all out determination to keep the Logan Lathe the most accurate in its field. This unflagging accent on accuracy from the first assembly to the final testing has done more than anything else to make the Logan Lathe outstanding in precision as well as in rugged strength. It explains, too, why so many industrial executives are depending on Logan Lathes both in tool rooms and on production lines. Ask your Logan Lathe dealer, or write for full information on all models of Logan Lathes.

No. 840
Quick Change Gear Turret Lathe

No. 200
Back Geared Screw Cutting Lathe

Brief Specifications

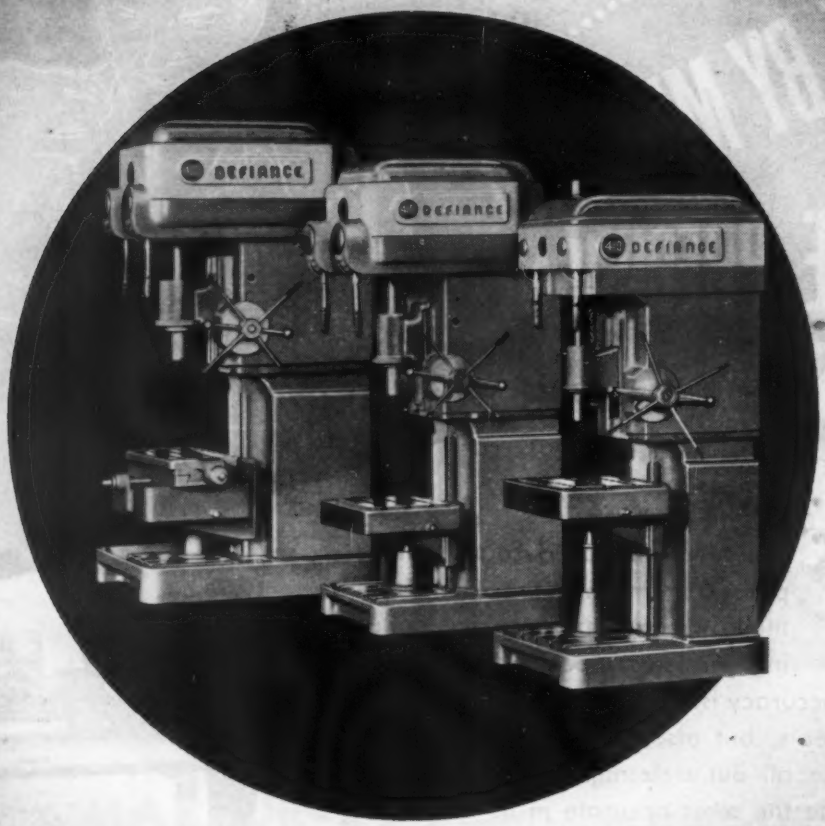
Common to all Logan Back Geared Screw Cutting Lathes, Hand Screw Machines, Quick Change Gear Lathes, and Manufacturing Turret Lathes, Bench, Floor and Cabinet Models

Swing over bed, 10½"
Bed width across ways, 6-15/16"
Bed length, 43⅛"
Size of hole through spindle, 25/32"
Spindle nose diameter and threads per inch, 1½"—8
Spindle speeds (back gears engaged) . . 30, 56, 104, 131, and 244 r.p.m.
Spindle speeds (direct belt driven) . . 179, 334, 420, 620, 780, and 1450 r.p.m.
Size of motor . . ⅓ or ½ h.p., 1750 r.p.m.
Preloaded precision ball bearing spindle mounting
Drum type reversing motor switch and cord
Precision ground ways, 2 prismatic "V" ways, and 2 flat ways

LOGAN ENGINEERING CO.
CHICAGO 30, ILLINOIS

C-1

QUICK CHANGE DRILLS



● The various models of the Defiance Quick Change Drills are rugged in design and made to meet the requirements of heavy production drilling and boring operations. The machines are of the quick change type with single direct reading levers. One for the selection of feeds, and one for the selection of speeds. Capacities of high speed drill in mild steel range from 1″ to 3″.

Master mechanics and production men have learned from personal experience that they can depend upon Defiance performance... unbeatable for minimizing expensive down-time and for low-cost, long-life operation. Write for new catalog. Defiance Machine Works, Inc., Defiance, Ohio.

ARMY (E) NAVY

DEFIANCE

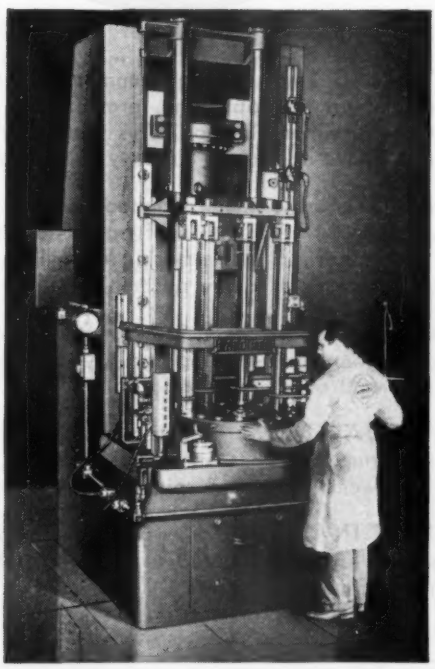
BUILDERS OF PRECISION MACHINERY SINCE 1850

• IF YOU PLAN FOR TOMORROW • • CONSULT LAPOINTE TODAY •

DREAMS TAKE A HOLIDAY

MANY progressive manufacturers have already rolled up their blueprints for the family "air flivver" of tomorrow and brought them to Lapointe for some 'plane facts on production planning. In most instances they have learned how additional broaching operations would enable them to mass-produce precision parts for their dream ships — quicker, cheaper . . . and better! In planning *today* the 'plane of tomorrow, aircraft manufacturers are counting on broaching to insure the highest degree of precision attainable while keeping machining costs at absolute "rock-bottom."

PROBABLY you, too, have a postwar product that is now more than just a designer's dream. If so, you will find it highly profitable to immediately consult the Lapointe engineering staff. After a careful analysis of both your product and plant, their recommendations will convince you that broaching will do the job better—at a considerable saving in time, space . . . and money!



Special V-7 with 4 broaches for finishing inside surfaces of propeller component.

★ ★ ★ ★ ★ ★ ★ ★ ★

Lapointe

MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

Construction Features that Contribute to...

POSITIVE CONTROL: Multiple dry disc clutch and leather faced brake in main spindle drive gives operator positive control with flexibility to allow "inching" spindle.

16 SPINDLE FEEDS: Gears of alloy steel, heat treated, finish machined and shaved, mounted on short, ground shafts and ball bearings, provide sixteen spindle speeds, in either direction.

SMOOTH SPINDLE DRIVE: Hardened, ground, and lapped spiral-bevel gears, ball bearing mounted, make sure a smooth spindle drive.

BORING RANGE: Four vertical spindle feeds for boring range from .002" to .010" per revolution.

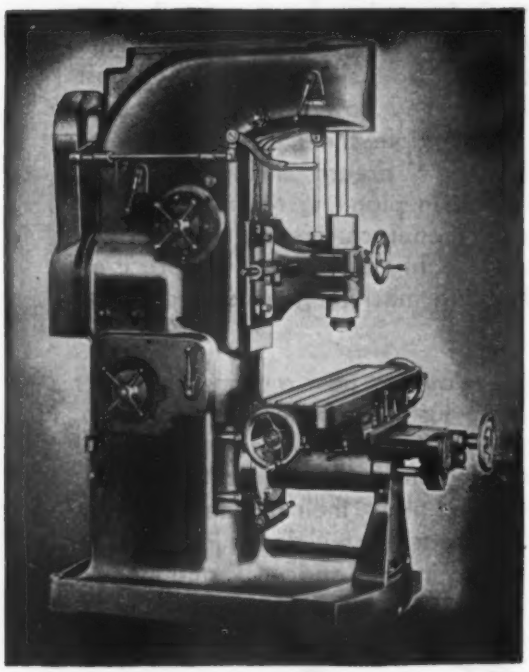
SPINDLE HEAD SECURELY LOCKED: Positive, quick acting spindle head clamp controlled by a single lever, securely locks spindle head in any position on accurately fitted slide on face of column.

MAIN SHAFT: Single, constant speed motor drives main shaft through multiple V-belts. Compact and accessible. Motor and drive entirely enclosed for safety and cleanliness. Guard easily removed for servicing or adjustment.

TABLE UNIT: A post, accurately ground and rigidly fitted into the column, forms the bearing on which the table unit swivels around the column.

★ VERSATILITY
★ SPEED
★ ABILITY
★ ACCURACY
★ RIGIDITY
★ ACCESSIBILITY and LOW COST
★ PERFORMANCE

ALL-PURPOSE KNIGHT-Millers



KNIGHT Millers are fast, compact, complete and convenient to handle. Write for our catalog that pictures and describes various jobs being done.

TILTING TABLE: Large trunnion, on which is assembled the table unit, provides for tilting table in either direction. This feature and the one above add to the capacity of the machine.

35° TILT: The knee, actuated by large worm and gear, may be tilted 35° either side of horizontal thereby placing the table in position for angle boring or milling. Four heavy T-slot bolts solidly lock it in any position.

SAFETY FEATURE: Automatic safety throwout, built into feed mechanism, provides against over-loading and will not allow re-engaging table feeds until overload is removed.

MAINTAINING SQUARENESS: Eccentric bushing, in outer table unit support bearing, furnishes additional means of maintaining squareness between table and spindle.

POSITION OF UNIT IN DEGREES: Large worm for operating gear that tilts table unit. Graduated segment on right side of unit gives position of unit in degrees.

KNIGHT Millers subject to prior order for immediate delivery. Write for catalog.

W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •

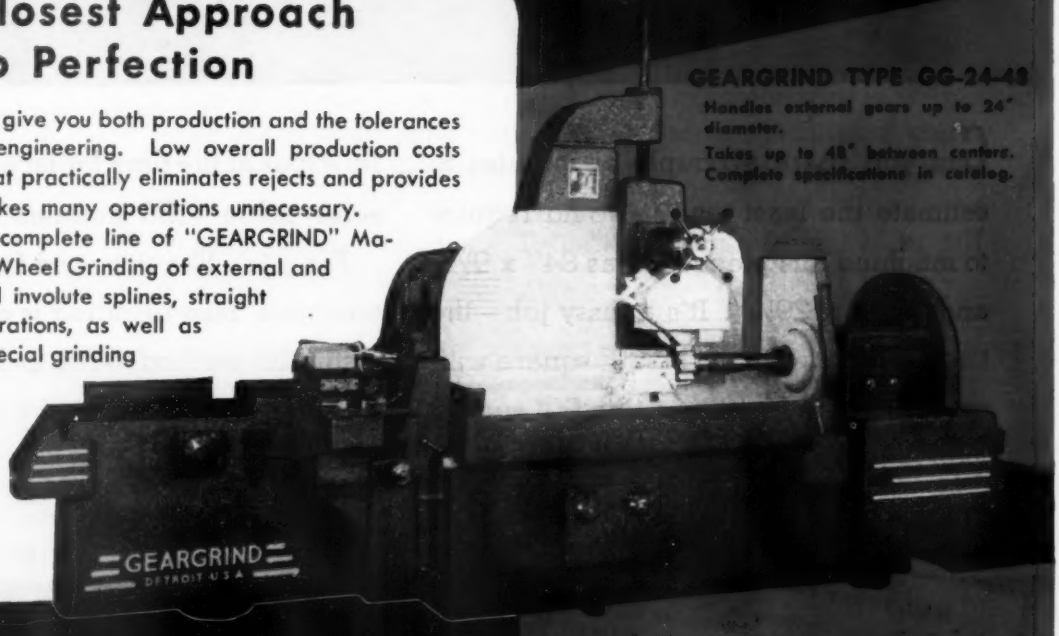
GEARGRIND Production

The Closest Approach to Perfection

GEARGRIND Machines give you both production and the tolerances required by modern engineering. Low overall production costs reflect the accuracy that practically eliminates rejects and provides the fine finish that makes many operations unnecessary.

We manufacture a complete line of "GEARGRIND" Machines for the Formed Wheel Grinding of external and internal gears, internal involute splines, straight splines, racks and serrations, as well as special machines for special grinding operations.

CATALOG ON REQUEST
Covers all GEARGRIND Machines and Contract Grinding Service.

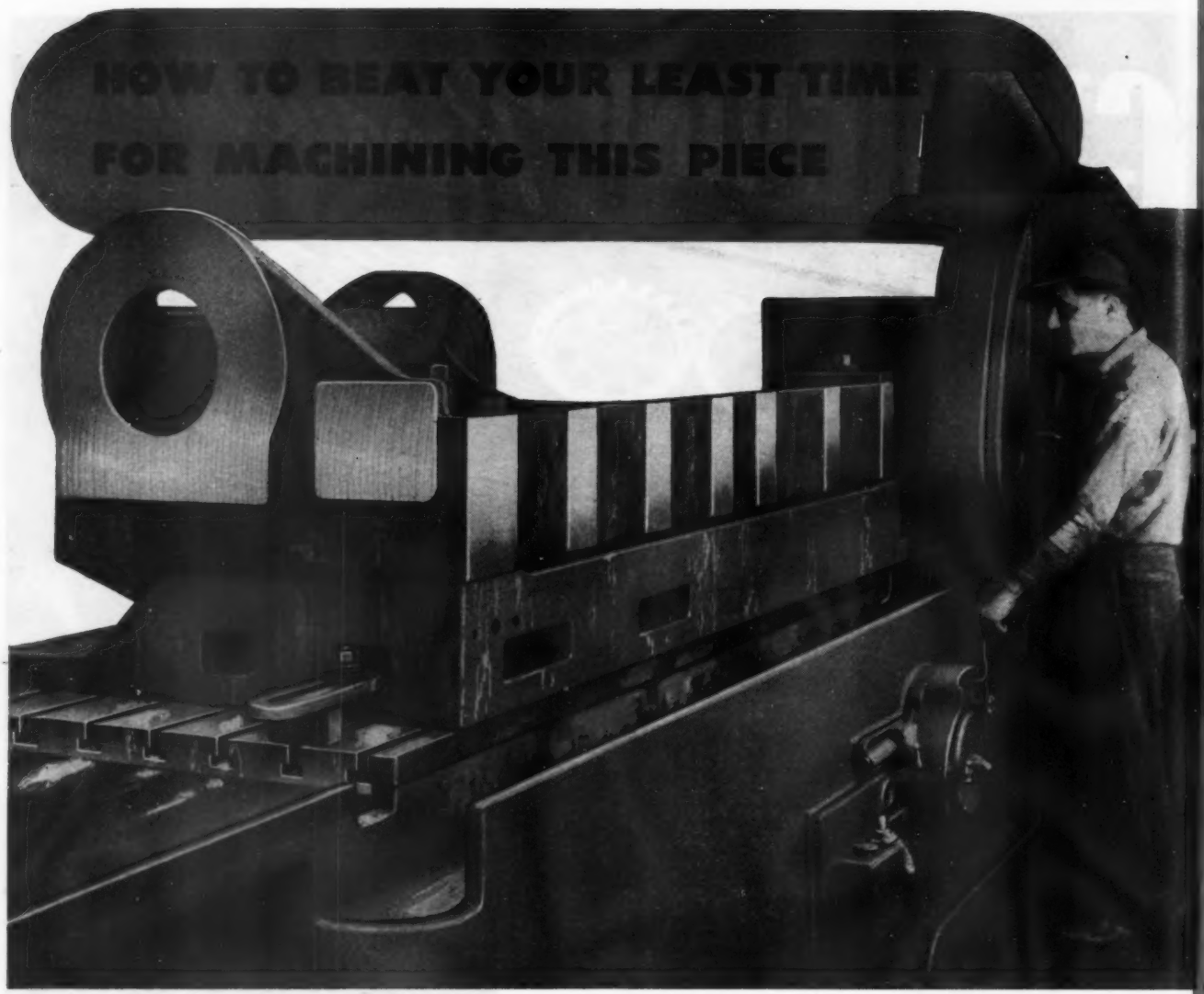


GEARGRIND TYPE GG-24-48
Handles external gears up to 24" diameter.
Takes up to 48" between centers.
Complete specifications in catalog.

The GEAR GRINDING MACHINE COMPANY
DETROIT 11, MICH. U.S.A.

ARMY E NAVY

Manufacturers of RZEPPA Constant Velocity Universal Joints



Can you spare a couple of minutes to estimate the least time it would require to machine this piece? Areas 84" x 9½" and 21¾" x 29½". It's a fussy job—the two sides shown must be 90° square with each other and both must be 90° square with the horizontal. What's your answer?

Now look at the time for face grinding the same piece—150 minutes floor-to-floor.

For a job like this, and for many a job you have, face grinding is often the only justifiable method. Write for Bulletin 44-G today and see how to save time and material by face grinding.

MAIL TODAY FOR NEW FOLDER

Diamond Machine Company of Philadelphia
2405-D Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: Please send me promptly your Bulletin 44-G which shows how to speed-up production with the Diamond Face Grinder.

Name _____ Title _____

Company _____

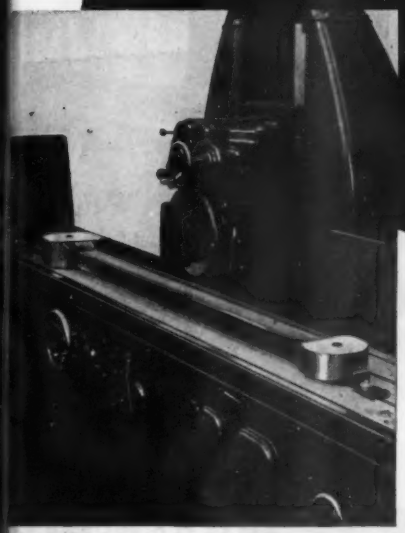
Address _____

City _____ State _____

"THE DIAMOND D THAT CUTS YOUR COSTS"

DIAMOND
MACHINE COMPANY
OF PHILADELPHIA

SIDE RODS, LINKS, GUIDES, VALVES, ETC. PRECISION GROUND WITH MATTISON SURFACE GRINDER

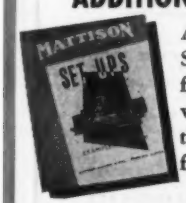


Locomotive side rods are accurately ground on Mattison Grinder. Grinding provides a flat surface for locating boring operations and permits checking alignment of rod while on locomotive. ←

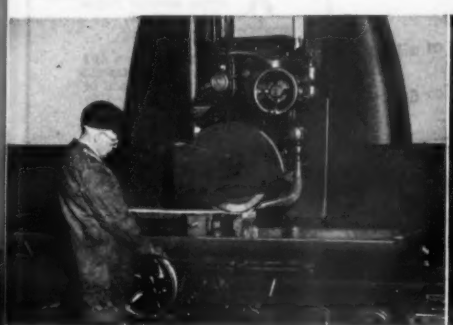
Increased speed of present day locomotives has made it imperative that moving parts be finished to close limits of accuracy. Illustration shows links being ground on Mattison Grinder. →

● The Mattison High-Powered Precision Surface Grinder can be used to advantage by railroad shops to speed up the finishing or reconditioning of parts to closest accuracy with fine finish. The Mattison Grinder has the high power and built in ruggedness required for rapid, heavy duty removal of metal. It also has the precision necessary to produce fine high quality finish and accuracy to the closest limits. Jobs ground with narrow wheels on small light machines or finished by other methods can be ground several times faster and with greater accuracy on the Mattison. The large size and capacity permits grinding one large part weighing up to several tons in weight or many small parts with equal speed and facility. Pictures show a few of the many jobs Mattison Grinders are capable of handling for railroad shops. For complete information send for free circular. Table sizes range from 12″ to 36″ wide to 192″ long.

ADDITIONAL INFORMATION



Also available is free Set-Up Book showing further examples of work ground on Mattison Grinders — Send for a copy today.



CROSSHEAD GUIDE

MAIN CROSSHEAD GUIDE

VALVE CROSSHEAD GUIDE

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

FASTER CUTS

CLEANER CUTS

STRAIGHTER CUTS

Save Time

Save Costs

assured by the PORTER-McLEOD COLD METAL SAWING MACHINE

Valuable time on war work can be saved by the 8" Porter-McLeod high production machine on all classes of work.

Its rating as a truly high production machine is the result of design features which make it possible to nest bars or shapes for multiple cutting, a method of holding the work securely during fast feeds, a unique upward blade movement through stock and a saw design which provides cutting action by every tooth.

These features result in remarkably fast, clean, straight cuts. Sturdy construction and ample power contribute to its ability to handle a standard feed of 3" per minute. Capacity: 8" round or 7½" square stock.

Explore the possibilities of the 8" Porter-McLeod Machine on your high production cold metal sawing operations. *Write today for Descriptive Bulletin.*

PORTER-McLEOD MACHINE TOOL CO., INC.

HATFIELD, MASS., U. S. A.

MACHINE TOOL Mc COMPANY

MOREY TURRET LATHES for BAR or CHUCKING { UNIVERSAL or PLAIN

3 UNIVERSAL

For bar stock up to 1½" in diameter
10" turning length
16½" swing over bed
Infinite spindle speeds: 55 to 1800 RPM. constant speed motor, 1200 RPM
AVAILABLE ALSO WITH PLAIN CROSS SLIDE
Ask for Circular 727A

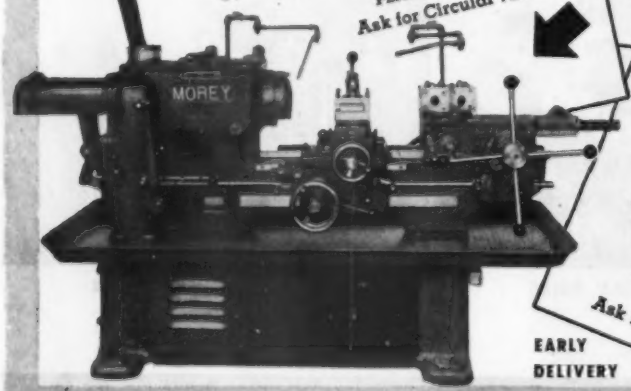
2 PLAIN-GEARED

For bar stock up to 1" in diameter
Turning length 6½"
Swing over cross slide 6"
Swing over bed 14"
Infinite spindle speeds:
Minimum of 60 RPM.
Maximum of 2000 RPM.
Constant horsepower at all speeds.
Ask for Circular 629A

4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length
19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM, constant speed motor, 1200 RPM
AVAILABLE ALSO WITH PLAIN CROSS SLIDE
Ask for Circular 736A

EARLY DELIVERY



INFINITE SPINDLE SPEEDS —Electrically Selected—

DIRECT BELT DRIVE AVAILABLE AT HIGH SPEEDS ELIMINATES GEAR MARKS (patents applied for).

GEARED SPINDLE SPEEDS INSTANTLY AVAILABLE THROUGH MULTIPLE DISC CLUTCHES.

SPINDLE MOUNTED ON TIMKEN BEARINGS.

RIGID—WITH SUFFICIENT POWER TO TURN AT THE HIGHEST SPEEDS AND FEEDS *MODERN* TOOLS WILL WITHSTAND.

SPINDLE SPEEDS AND POWER FEED CHANGES WITHIN EASY REACH OF OPERATOR.

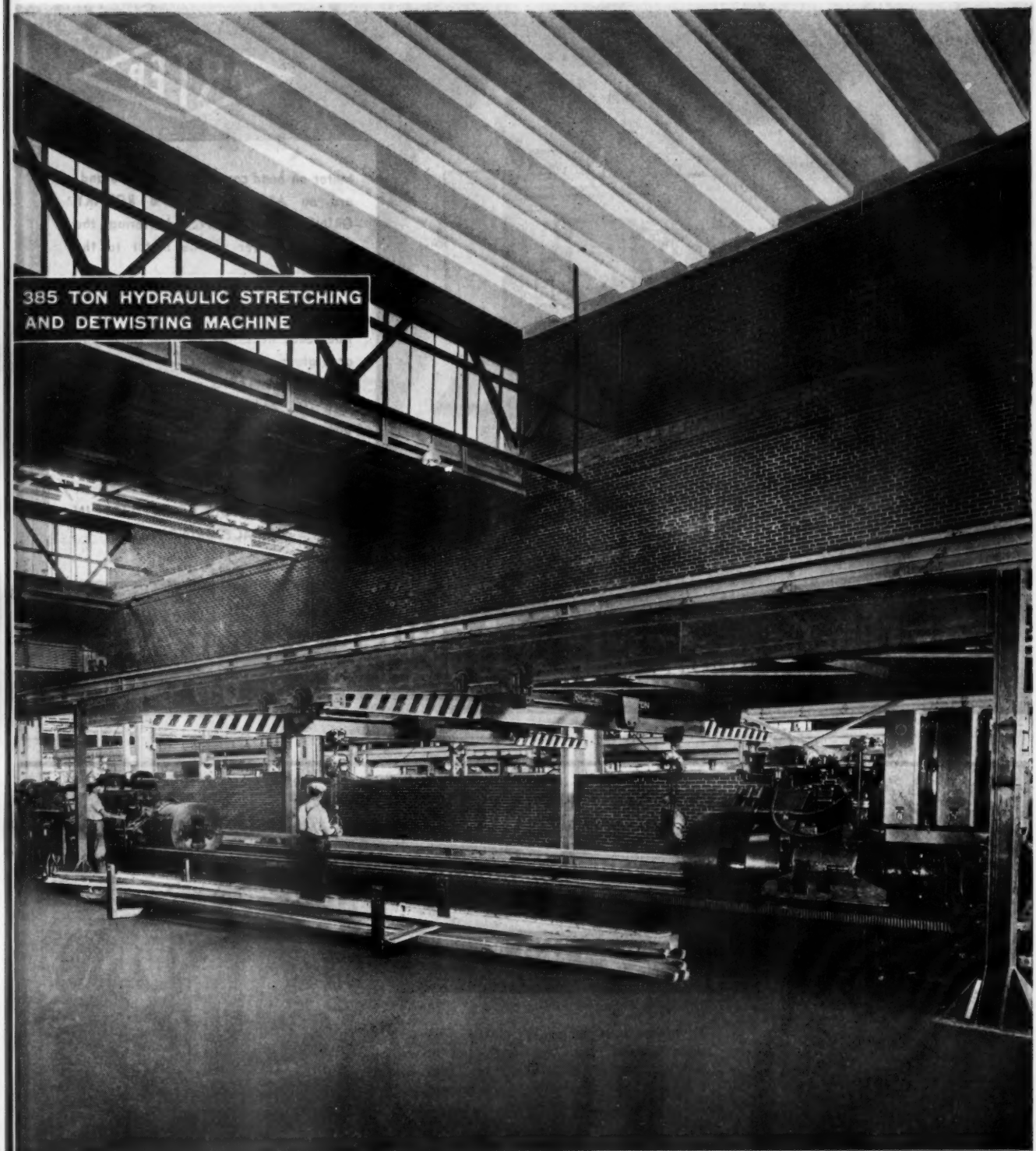
ARMY E NAVY

THE DESIGN OF THE MOREY No. 2, 3 and 4 TURRET LATHES ARE BASICALLY ALIKE. EACH MACHINE IS ENGINEERED FOR THE SIZE WORK IT IS DESIGNED TO HANDLE.

DESIGNED AND BUILT BY

MOREY MACHINERY CO., INC

410 BROOME STREET, NEW YORK 13, N. Y.
PLANT: 4-57 26TH AVE., ASTORIA 2, NEW YORK



HYDROPRESS · INC.

ENGINEERS *CONTRACTORS*

HYDRAULIC PRESSES · ROLLING MILLS
STRETCHERS · PUMPS · ACCUMULATORS

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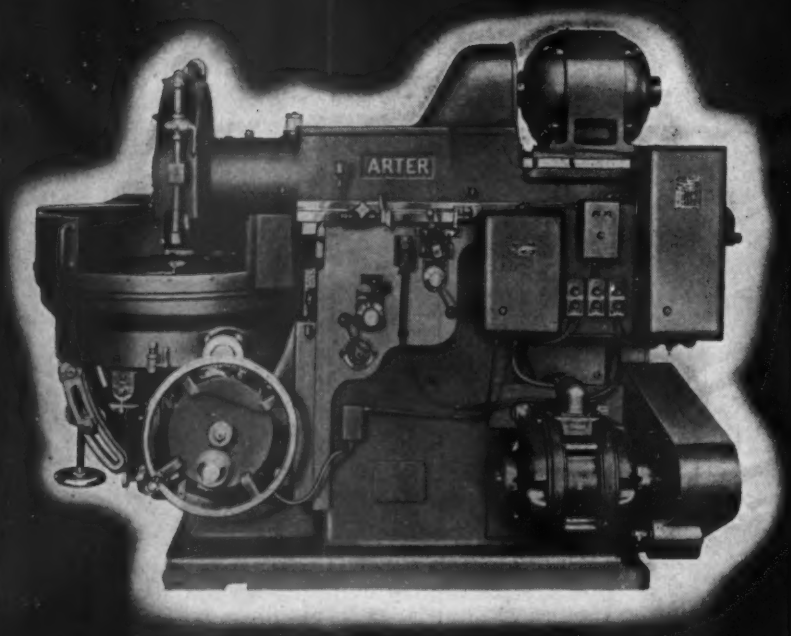


ARTER

Motor-on-head construction is now standard on ARTER MODEL B ROTARY GRINDING MACHINE, delivering the maximum power of the motor to the spindle.

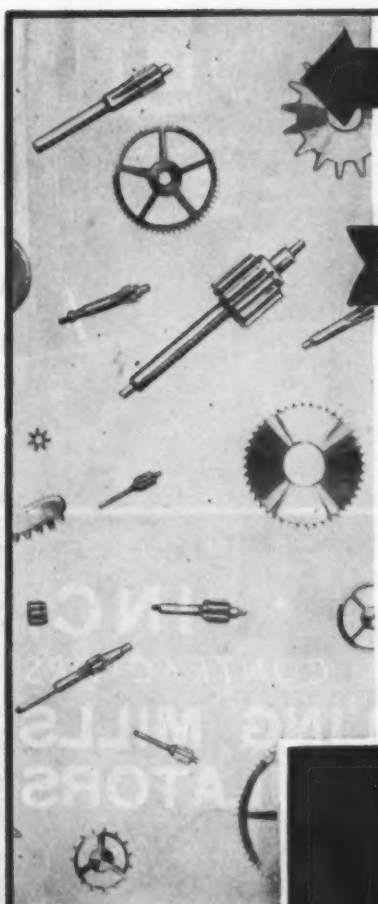
MODEL B ARTER ROTARY GRINDER makes heavy roughing cuts as well as fine feeds necessary for fine finish and accurate sizing.

MODEL B ARTER is made in four sizes with 20", 24", 30" and 40" chuck capacities. Vertical capacity of 8" is standard, but machines up to 30" vertical capacity can be furnished.

ARTER GIVES YOU VERSATILITY IN SURFACE GRINDING

ARTER GRINDING MACHINE COMPANY

WORCESTER, MASSACHUSETTS • U. S. A.

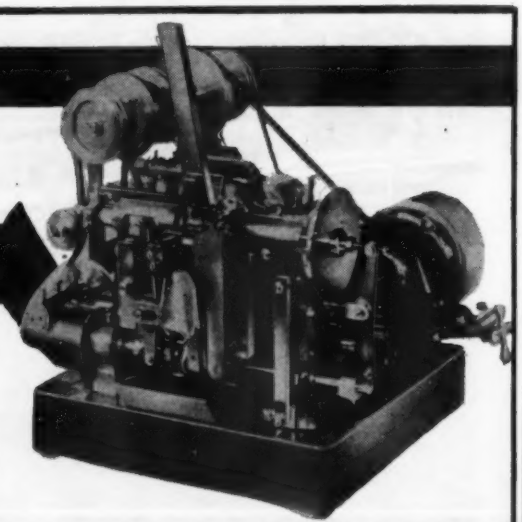


Parts like these

are produced quickly and accurately on

WALTHAM

PINION & GEAR CUTTING MACHINES



These bench machines, for cutting fine pitch gearing, such as those used in watches, instruments, time fuses, etc., employ a revolving cutter which makes successive cuts. Blanks are held and indexed by the work spindle. Only straight cuts can be made.

Cutter spindle is designed for high speeds. The entire machine is sturdily built for precision and long life. Each type machine is convenient, easy to operate and highly productive.

Full details and specifications are available on request.

Available in the following Types

In each of the following machines, the same cutting method is used, namely a revolving cutter which makes successive cuts on blanks held and indexed by work spindle.

Single-Cut Pinion Machines, Multiple-Cut Pinion Machines, Magazine-Fed Pinion Machines, Gear Cutting Machines

CAPACITY: Pinion Machines, ¼" dia.
Gear Machines, 1½" pitch dia.

WALTHAM
TRADE MARK REGISTERED U.S. PAT. OFF.

WALTHAM

MACHINE WORKS,

WALTHAM, MASS.

Truly an ACE
AMONG TOOL AND CUTTER GRINDERS!

•

OLIVER ACE TOOL AND CUTTER GRINDER

RADIUS GRINDING FIXTURE, capacity up to 6". Special fixture supplied as an extra.

We named this Cutter Grinder ACE because it is absolute "tops" in all the qualities that go to make up a SIMPLE, ACCURATE, HANDY and ECONOMICAL Universal Tool and Cutter Grinder! The ACE produces mathematically correct cutting teeth and edges on a wide variety of qutters and tools—Face Mills up to 15" dia., End Mills, Side Mills, Spot Facers, Angular Cutters, Formed Cutters, Reamers, Hobs, Gear Cutters, Double Angle Cutters . . . and many more. The two complete fixtures which are supplied are all that are necessary for a majority of tools; and simple, inexpensive special fixtures broaden still further the range of work which the ACE will perform. *Write for bulletin illustrating various typical as well as unusual applications.*

Don't Neglect Your Toolroom It's the Backbone of Production!

OLIVER INSTRUMENT CO.
1414 E. Maumee St., Adrian, Michigan

Oliver OF ADRIAN

AUTOMATIC DRILL GRINDERS — TOOL AND CUTTER GRINDERS — DRILL POINT THINNERS — TEMPLATE TOOL GRINDERS — FACE MILL GRINDERS — DIEMAKING MACHINES

Kalamazoo
METAL CUTTING
BAND SAW

Continuous Production and Low Cost on **CUT-OFF WORK**

A modern, high speed, low cost production unit for cutting off rods, bars, tubes or odd shapes to lengths. Extremely accurate. Narrow kerf saves costly metal. Labor saving automatic operation. No heat generation. Long life for saws.

Coolant attachment is compact and has no messy floor pans.

Portable and plugs in anywhere. Casters optional.

Machine can be furnished without coolant for intermittent cutting.

Two sizes—8" x 16" and 8" x 24".

Ask your dealer for bulletin

MACHINE TOOL DIVISION • **KALAMAZOO TANK & SILO CO.**
KALAMAZOO, MICHIGAN

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If you plan to change the address to which your copies of AMERICAN MACHINIST are sent, let us know now. We don't—and we're sure you don't—want a single issue to be delayed in reaching you. Coupon below is for your convenience.

American Machinist, 330 W. 42nd St., N. Y.

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Title .....

Company .....

Address .....

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MY NEW ADDRESS

Name .....

Title .....

Company .....

Address .....

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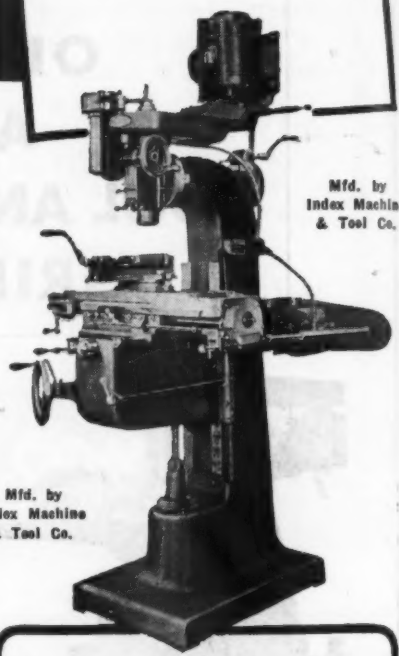
INDEX MILLS

will help you on your tool, die and production work. In addition to micrometer dials on screws, verniers are standard equipment for cross and longitudinal locating. If finer precision is desired, rods and indicators are available. These in conjunction with power feed to a precision ball bearing spindle make a very versatile machine for milling, drilling and boring. *Literature promptly mailed on request.*



Mfd. by Index Machine & Tool Co.

Mfd. by Index Machine & Tool Co.

12" Tool Room Rotary Table

Mfd. by Index Machine & Tool Co.

A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

For use on Index Mills or any other machine that will accommodate a 12" table.

BLANK and BUXTON MACHINERY

3100 E. MICHIGAN AVE.
JACKSON, MICH.

This De Laval "Uni-Matic" Oil Purifier keeps hydraulic oil in clean, usable condition at the Euclid Case Plant Division of Chase Brass & Copper Co., Inc.

...Purify Factory Oils

PURIFICATION of hydraulic oil by means of a DeLaval Centrifugal Oil Purifier accomplishes two important results: (1) Pumps used for maintaining the necessarily high pressures in hydraulic cylinders will last longer and require less attention; (2) Danger of pilot mechanism sticking will be minimized.

De Laval oil purification units similar to that shown above maintain at peak efficiency many other kinds of factory oils by removing dirt, grit, metallic particles and water. Included are cutting oils, test oils, washing oils, honing oils, slushing oils, and many others.

Another centrifugal, the De Laval "Hermetic" Coolant Clarifier, by removing harmful abrasives from grinding coolant, permits grinding to closer limits, prolongs wheel life, and enables finer finishes to be produced.

Write for Bulletin FF, "De Laval Purifiers for Factory Oils," for details on many profitable applications for De Laval machines in metal-working plants. It will be sent on request.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

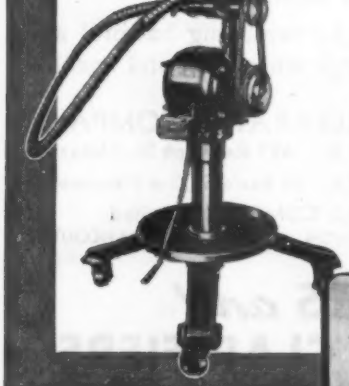
De Laval PURIFIERS *and* CLARIFIERS *FOR FACTORY OILS*

FOR GREATER OPERATING EFFICIENCY

SAVE *Critical* TIME!

TIME CANNOT BE SALVAGED

Once it's gone there's no reclaiming it. But you can cut your finishing time 'way down with Haskins Flexible Shaft Equipment. Forget old hand-finishing methods. Your men will work faster and better, with less fatigue, the Haskins way. Every hour will see increased production. Man-hours—plus machine-hours—will really mean something. For important new time-saver methods, send for your copy of Catalog 45. R. G. Haskins Company, 2760 W. Flournoy Street, Chicago, Illinois.



H-6

1/2 H.P. Countershaft drive, 4-speed —900—3400 R. P. M. Bench height pedestal mounting, 360 degree swivel.

HASKINS
Flexible Shaft
EQUIPMENT
More VERSATILE Machines for More PROFITABLE Work

KEYSEATING

The Modern Way

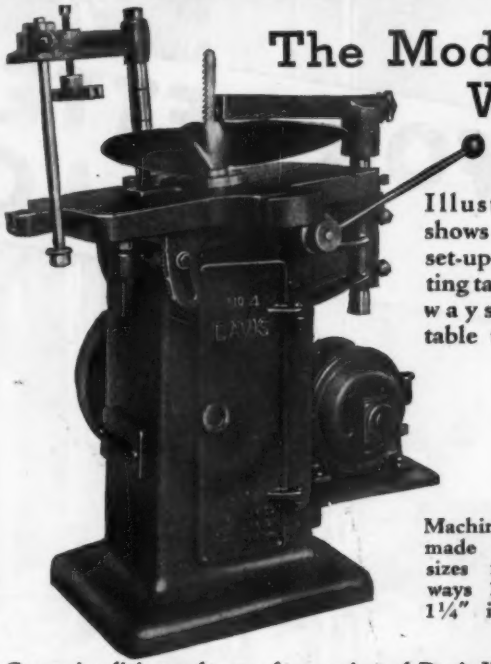


Illustration shows typical set-up for cutting taper keyways with table tilted.

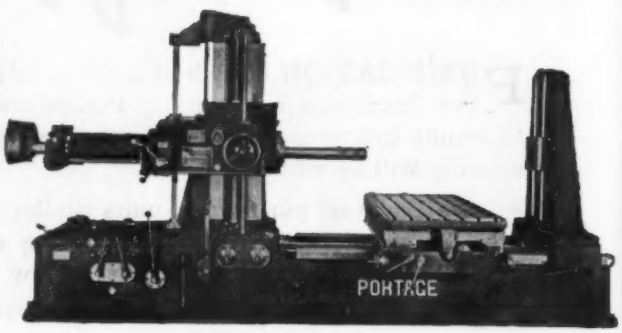
Machines are made in three sizes for keyways 1/16" to 1¼" in width.

Great simplicity and ease of operation of Davis Keyseaters assure the user of accurate, time saving work.

Let our engineer study your keyseating problems.

DAVIS KEYSEATER COMPANY
403 EXCHANGE ST. ROCHESTER, N. Y.

PORTAGE



NO. 4 HORIZONTAL BORING DRILLING & MILLING MACHINE

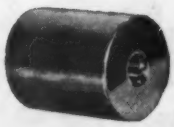
• A ruggedly built machine capable of operation at maximum speeds and feeds to produce accurately finished work. . . . Machine furnished with coolant type table with either 36" x 60" working surface and 48" cross travel, or 48" x 72" working surface and 60" cross travel. . . . Extra height columns increase working capacity. . . . For greater speed—precision—high production specify PORTAGE.

WRITE for full descriptive bulletin today.

THE PORTAGE MACHINE CO.
AKRON 11, OHIO

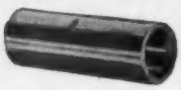
TYPICAL JOBS

Aircraft Hydraulic Brake Cylinder. Honing 3 times faster than lapping — and gave a straighter hole.



Header Die. Life of header dies increased 3 to 9 times over lapping. Knockout pin breakage practically eliminated.

Aircraft Instrument Panel Control Wire Bushing. Hole .187" diameter — held to .0002", stock removal .001", sixty per hour.

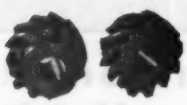


Aircraft Piston Pin. Sunnen honing is twice as fast and gives a cleaner, better looking pin.

Stainless Steel Load Compensator Valve Seat. Hole is honed to .0002" limit.

Aircraft Valve Tappet Roller. Honed after grinding to give 100% bearing surface.

Aircraft Carburetor Operating Valve Sleeve. Sunnen honing eliminates distortion from assembling operation.



Automobile Distributor Shaft Gears. Taper removed at a rate of 80-90 per hour.

Roller Bearing Outer Race. Finish improved from 12 micro-inches to 2 micro-inches.

Bearing. A very small part. 2 micro-inch finish necessary.

Carbureter Idler Valve Jet. Hole is honed after reaming for smooth action.

Shell Loading Die.

Aluminum Aircraft Link produces high finish without bell-mouthing.

Compressor Yoke. Alignment maintained and better finish produced.

For Today's War Production-

for Tomorrow's New Products

The Sunnen Precision Honing Machine will quickly hone and finish to an accuracy of .0001" or better. In fact, accuracy on hardened steel parts has been held to .000025" on production jobs. In addition to this extreme accuracy in producing a straight, round hole, the Sunnen Precision Honing Machine produces a super-smooth finish of 2 to 3 micro-inches. This means a smoother surface that holds a better film of lubricant — producing smoother operation and longer life.

Here are a few facts about the Sunnen Precision Honing Machine: Hones and finishes internal cylindrical surfaces from .185" to 2.625" in diameter — with a guaranteed accuracy of .0001" — can be used in any metal or plastic, except lead or babbitt — no jigs or fixtures needed — requires no skilled labor — can be set up to operate in one minute — is economical to operate.

Get complete information on how the Sunnen Precision Honing Machine can give you better, more accurate finishes with greater speed. A Sunnen engineer will be glad to call on you — or write for a free descriptive bulletin.

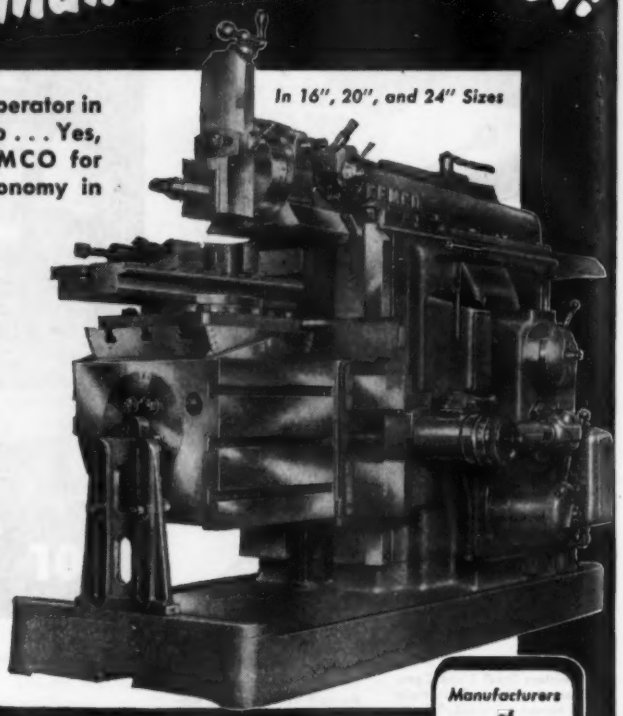
SUNNEN PRODUCTS COMPANY
7941 Manchester Ave. • St. Louis 17, Missouri
Canadian Factory: Chatham, Ontario

SUNNEN HONING
Speed ★ Accuracy ★ Finish

It's a Lazy Man's Machine Tool!!

Said one GEMCO Shaper operator in a leading tool and die shop . . . Yes, there's nothing like a GEMCO for ease, convenience and economy in operation.

The Universal Type of GEMCO Shaper, shown at right, is ideal for tool and die work, or where angular work set-ups are required. Time-tested features: Exclusive "Lubrigard" Safety Device increases the precision life—Centralized Controls save time and effort, increase production—Large, easy-to-read dials—Wide range of feeds and speeds.



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Multi-Purpose SHAPERS

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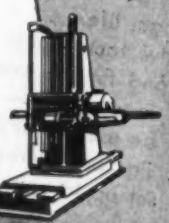
PRODUCTION SPEEDING RADIAL DRILLS AND HORIZONTAL DRILLING, BORING AND MILLING MACHINES



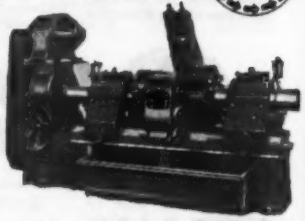
DETAILS ON REQUEST

THE CINCINNATI GILBERT MACHINE TOOL CO.

CINCINNATI, OHIO

Horizontal ROTO-MATICS

When high production is in demand on your machining problems your requirements can be met with a Horizontal Roto-Matic. Continuous, non-indexing operation together with roughing and finishing spindles insure maximum output. *Bulletins 110 and 120* are available for suggested solutions to your problems.



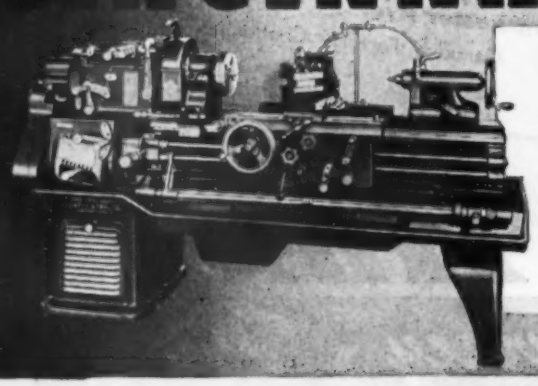
No. 1-A Continuous Rotary Drum Type Miller

Davis and Thompson Co.

Mfrs. of Machine Tools and Micrometers

6411 W. Burnham St. Milwaukee 14, Wisconsin

CINCINNATI LATHES



MORE AND BETTER WORK AT LOWER COST

Experience in many shops proves the cost-cutting ability of these modern, fast, accurate lathes. Performance is consistently accurate . . . work is conveniently handled. You can depend on Cincinnati Lathes for more and better work at lower cost and for tooling that will exactly meet your requirements. Sizes: 14" to 30". *Full details on request.*

THE CINCINNATI LATHE & TOOL CO.

Rogers Road, Oakley SPECIALISTS SINCE 1906 Cincinnati, Ohio

MATCHED SETS OF MILLED CHASERS

Note how chaser mounted in a COVEL Precision Vise is adjusted to correct angle for grinding chamfer. Operator uses same setting of grinding machine and vise for remainder of matched set. Vise is Universal Angle Style "A" with 1¼" square capacity, 2¾" jaw width, and is 4¼" high. Work can be mounted in any combination of angles.

Perfectly Sharpened

on COVEL No. 22 UNIVERSAL

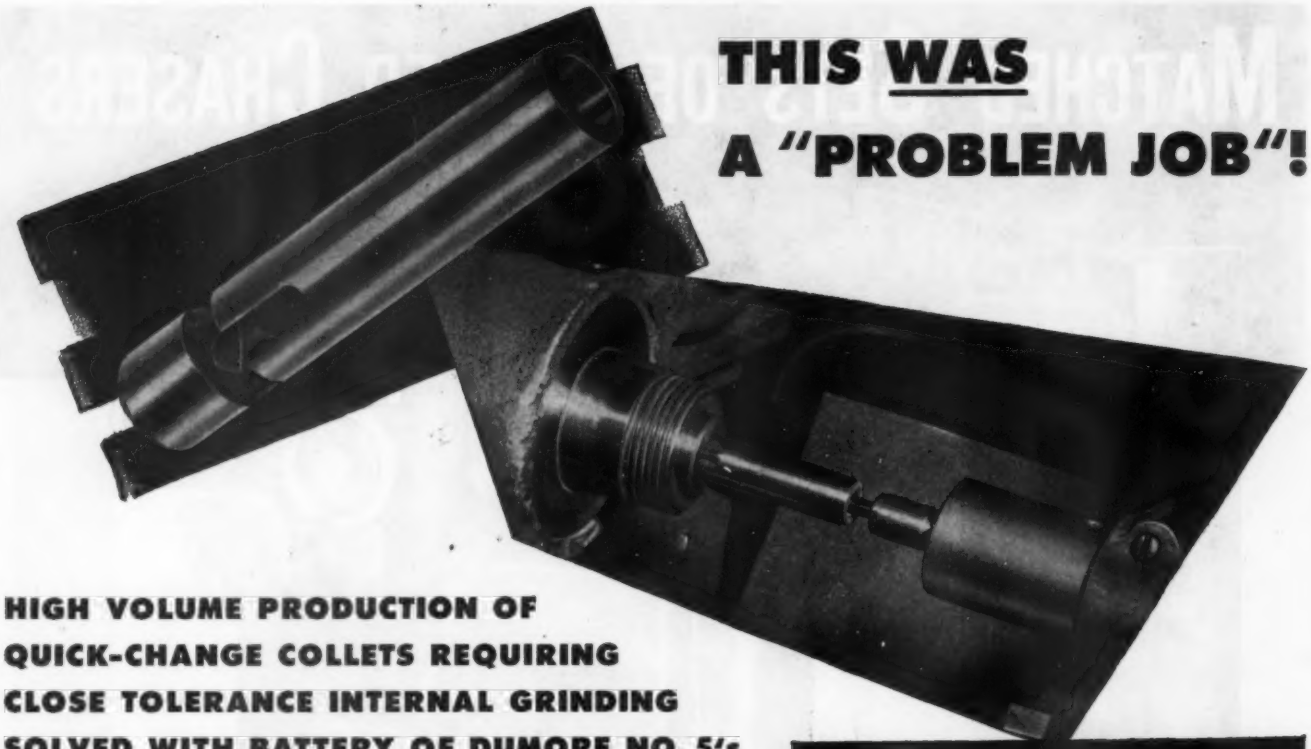
Don't take a chance when sharpening matched sets of milled chasers. The COVEL No. 22 Universal Cutter and Tool Grinder does the work in less time and with such a high degree of accuracy that two or a hundred chasers may be used interchangeably in the same die head. This is just another example of the versatility of the COVEL No. 22 Universal.

See Your Nearest COVEL Dealer or Write for Bulletin A-95

GRINDING MACHINERY SINCE 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICHIGAN U. S. A.



THIS WAS A "PROBLEM JOB"!

HIGH VOLUME PRODUCTION OF QUICK-CHANGE COLLETS REQUIRING CLOSE TOLERANCE INTERNAL GRINDING SOLVED WITH BATTERY OF DUMORE NO. 5's

Quantity internal grinding of a small diameter with a No. 1 Morse taper was demanded quickly in a large tool manufacturing plant. The quick-change collets to be produced became a problem job. But not for long. Dumore No. 5 Precision Grinders were mounted on milling machine bases and the threatened production bottleneck was smashed. Increased production, machine tool shortages and inexperienced help again were overcome through the versatility and adaptability of the Dumore No. 5 Precision Grinder. By using the Dumore No. 5, you use a tool that can be set-up easily on any standard machine tool, that can handle a wide range of external and internal grinding with its 15 quick-change quills, and a tool that can maintain precision to .0001"! The Dumore Company, Tool Division, Dept. TD14, Racine, Wisconsin.

• Dumore No. 5 Precision Grinder, mounted on milling machine base, licks the "problem job"!

Get your copy now!

• The current issue of "Shop Talk" contains complete data on this application plus interesting facts on other grinding problems. Write for your copy today!

Get grinding volume at low cost with

DUMORE

PRECISION AND HAND GRINDERS

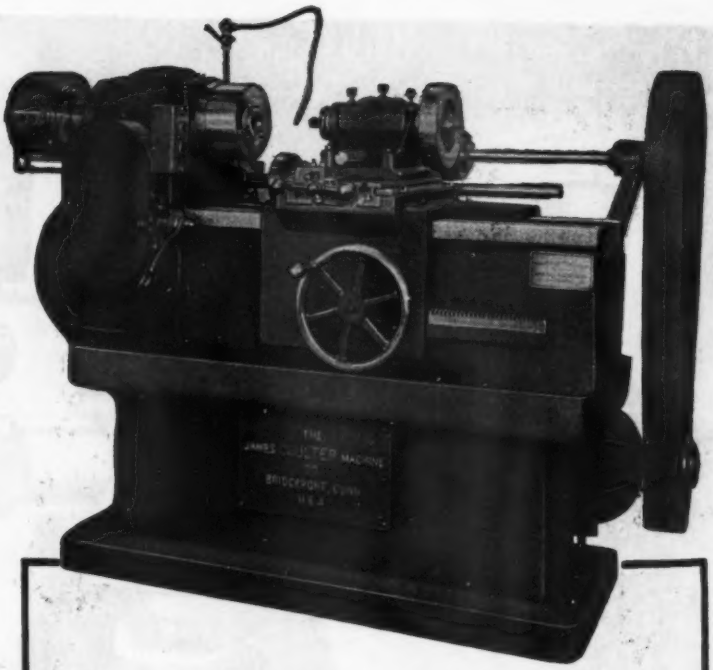
Sold by Authorized Industrial Distributors in All Principal Cities

Longitudinal Feed — 20"
Cross Feed — 9"
Vertical Feed of Knee — 16"
Standard Table — 9" x 32"
Special Tables up to 48" available; also longitudinal power feed
Weight with Shaping Unit — 2000 lbs.

If a machine tool is just good enough to get by now, it won't have much of a chance to stay on the job when costs are really scrutinized. BRIDGEPORT TURRET MILLING MACHINES, on the other hand, have so much more "on the ball" than is actually required of them, that their position in post-war production is definitely assured. They mill, drill, bore and shape at all angles without change in set up. Write for details.

The Bridgeport MACHINES, Inc.
Bridgeport, Conn.

Keep Ahead of DEFENSE DEMANDS on the PRODUCTION of EXTERNAL and INTERNAL THREADS



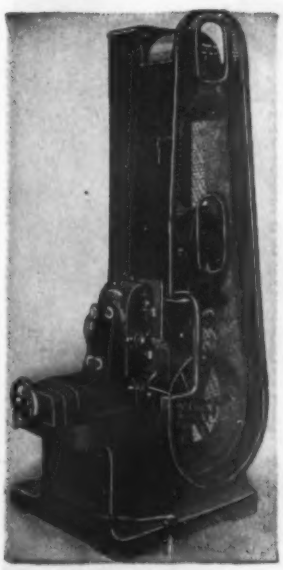
The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

Maximum external thread, 7"; minimum hole depends on smallest hob practical.

Send for Descriptive Bulletin giving full information.

The James COULTER Machine Co.
BRIDGEPORT • CONNECTICUT • U.S.A.



Type A "PRODUCTION" HIGH SPEED CENTERLESS FEED *Polishing and Finishing Machine*

for cylindrical, tapered or flat work

This most recent development for high speed polishing employs the Duplex Patent Two-Belt Process. This system comprises an abrasive belt running over a patent cushion leather belt, a combination which provides high points for cutting and low points immediately adjoining for chip clearance. As a result of the Duplex Two-Belt System, this machine can be depended on not only for high speed finishing but for *quality* finish of outstanding superiority.

Automatic tension devices maintain correct tension of both abrasive and cushion belts at all times and provide for quick and easy belt change.

SPECIFICATIONS

Capacity: With power attachment, round stock from ¼" to 6" diameter. For hand work, anything within range of belt and holding ability of operator.

Speeds: Driving pulley 1200 R.P.M.; leather cushion belt, 6300" per min.

Send for illustrated literature giving complete information.

PRODUCTION MACHINE CO.
Manufacturers of Drilling Machines, Tool Grinders and Hand and Automatic Polishing and Grinding Machines.
GREENFIELD, MASS., U. S. A.

SMITH & MILLS CRANK SHAPERS

sizes 12" to 32" stroke

THE SMITH & MILLS CO. Cincinnati, Ohio

Giant KEYSEATERS

For cutting internal keyways, slots or splines 1/16" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

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Automatic DRILLING - BORING MILLING - TAPPING Units

½ to 20 HORSEPOWER DRIVE

AUTOMATIC and SEMI-AUTOMATIC PRODUCTION MACHINERY

W. K. MILLHOLLAND MACHINERY CO.
Indianapolis, Ind.

BUY MORE BONDS

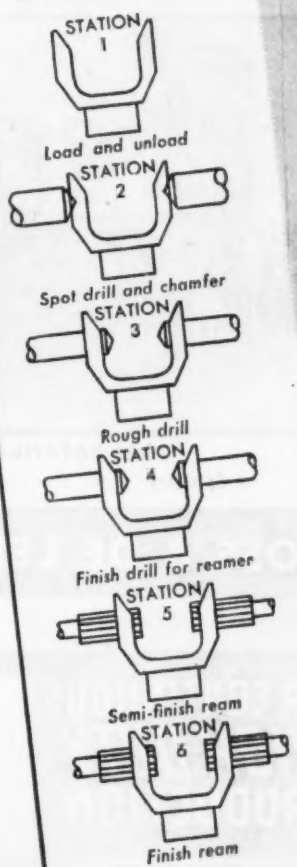
LINE REAMING ACCURACY *from Two Directions* *on this* LEMAIRE 2-WAY TRUNNION TYPE MACHINE

BECAUSE it reams from two directions—with each tool doing half the work—this LeMaire machine presents many advantages in production.

It is a six-station way type machine, designed primarily to drill, chamfer and ream yokes 1½" in diameter. But its flexibility permits the same operations to be performed on yokes ranging down to ⅞" diameter.

The reamers are driven by a special quill-type spindle built in the trunnion with the power from multiple head transmitted through flexible drive. It has a manually operated 6-station trunnion mounted on a fabricated center base to which are attached two standard LeMaire self-contained, slide-type Hydraulic Units. These units have change gears to provide various spindle speeds for the 5-spindle drill heads.

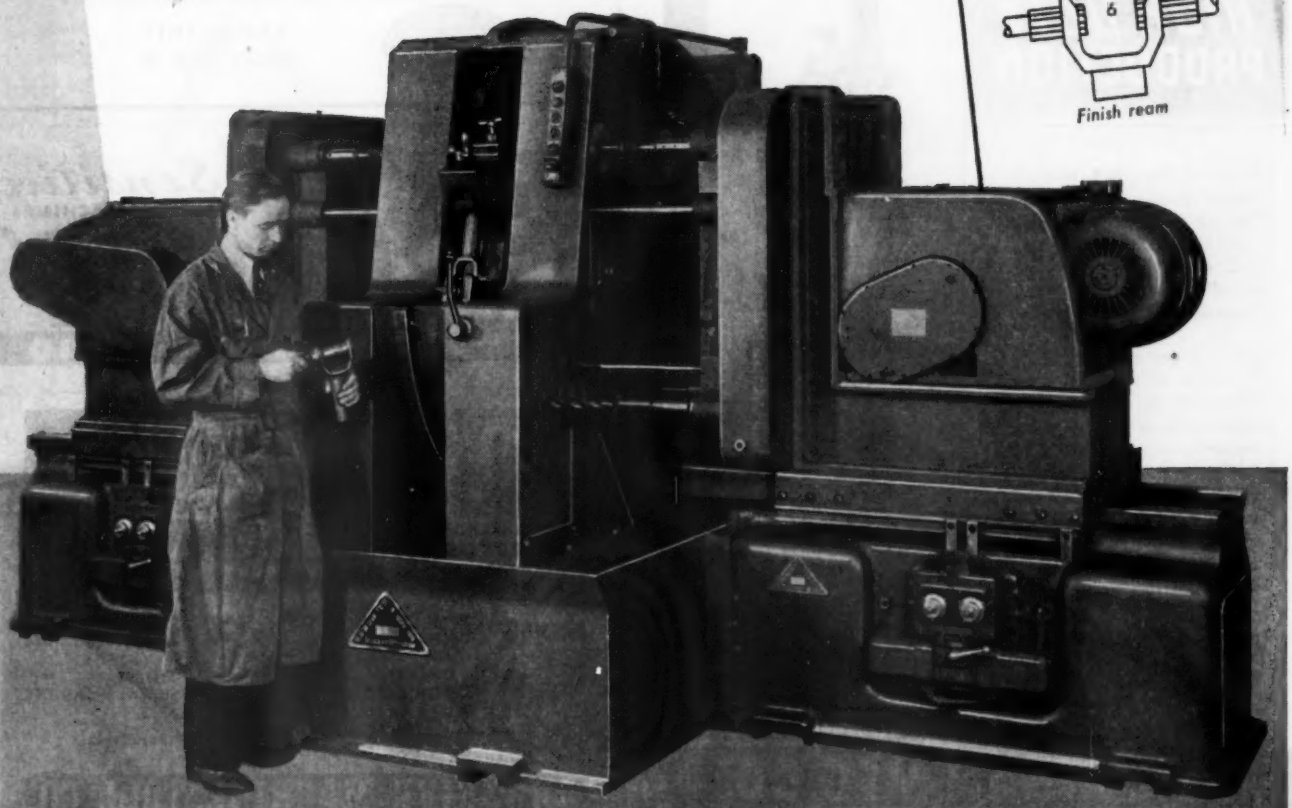
CYCLE OF OPERATIONS



Our engineers will be glad to share their experience with you on any problems that deal with drilling, reaming, tapping, etc. where increased production is sought.

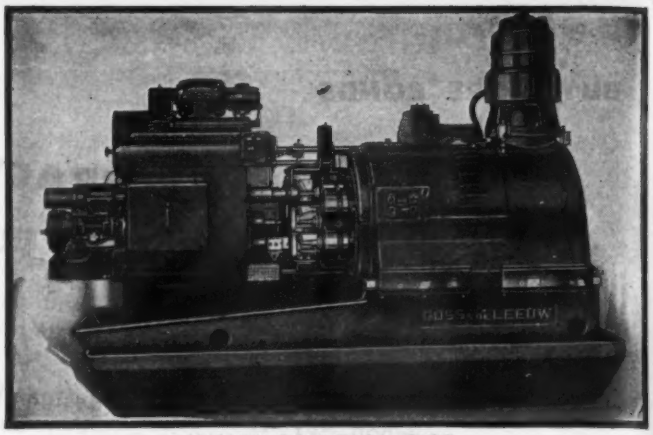
LeMaire

BUILDERS OF UNIT AND WAY TYPE MACHINES FOR SINGLE OR MULTIPLE SPINDLE DRILLING, BORING, REAMING, TAPPING, ETC.—TWIN RAM HYDRAULIC UNITS—MATCH-IT GEAR CHUCKS



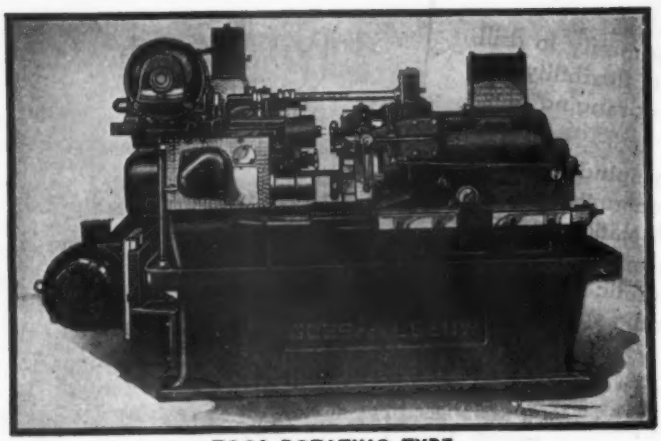
LEMAIRE TOOL & MANUFACTURING CO., 2657 SO. TELEGRAPH RD., DEARBORN, MICH.

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



TOOL ROTATING TYPE

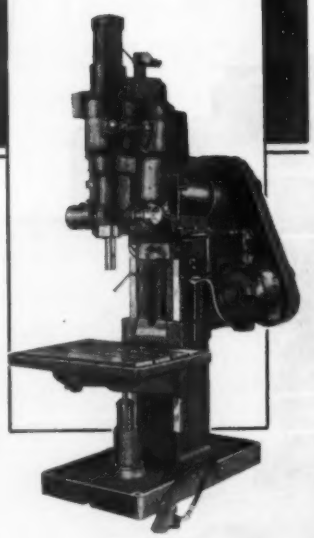
4 Spindles • 5 Chucking Positions

Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

FOR CONTINUOUS *HIGH DUTY* PRODUCTION



Kaufman No. 10A Hi-Duty single spindle. Lead Screw Tapper made in 3 HP and 1½ HP models, with ¾" N.C. and 1½" N.C. Threads in alloy steel offers these features:

FULLY enclosed . . . lead screw and nut operate constantly in oil bath . . . positively wear-proof clutches instantly engaged and controlled by air cylinder . . . quick traverse when not actually cutting threads . . . accurate depth control . . . control to protect tap overload, and further protected against jamming if work is placed in upside down . . . class 3 fits always assured and perfectly controllable.

Send now for complete catalog information.

KAUFMAN MFG. CO.
MANITOWOC, WISCONSIN

LUCAS "PRECISION"

Horizontal Boring, Drilling and Milling Machine

THE LUCAS MACHINE TOOL CO.

NOW AND ALWAYS OF

CLEVELAND
OHIO, U. S. A.

Sensitive DRILLING MACHINES

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ABRASIVE

ACCURACY BOOSTS PRODUCTION

No. 1G	INTERNAL GRINDER	**No. 34**	VERTICAL SPINDLE SURFACE GRINDER
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ABRASIVE MACHINE TOOL CO.
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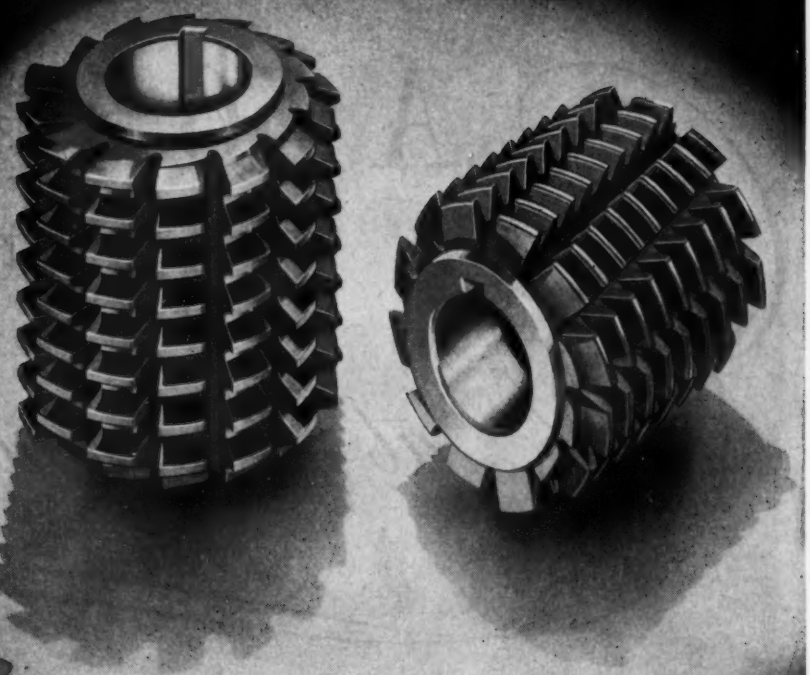
Get the most from your HOBS



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Leading distributors in every section of the country have stocks of National Cutting Tools. Every National distributor offers factory trained engineers to serve you. Call your National distributor for cutting tools or any staple industrial product.

You can't be too careful when mounting a hob in the hobbing machine. Always use an indicator to make sure the hob is running true on the arbor. Better work is obtained by taking back lash and wear out of the machine's moving parts.

You can secure increased production and longer tool life if you specify National Hobs for your hobbing operations. Use the right tool for each job.

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Finding "better ways"...

A 56 YEAR HABIT *at Peninsular*

DAY AFTER DAY for more than 56 years, Peninsular engineers have carried on their search for new materials—new methods—better ways to manufacture grinding wheels and apply them to the problems of production in industry.

How well they have succeeded is reflected in the excellent reputation which Peninsular enjoys throughout heavy industry and wherever grinding wheels are used.

It can also be measured by the fact that many of the basic advancements in the fabrication of grinding wheels—in the machinery for their manufacture—and in their application to modern industrial problems have come from Peninsular.

Yes, finding "better ways" is definitely a habit with Peninsular—a habit you can count on in the future as industry turns to peacetime production.

A STANDING INVITATION

Our expert staff of factory and field engineers are ready today to help in your preparation for regular production—with an engineering and cost analysis service beyond any offered up to now in industry.

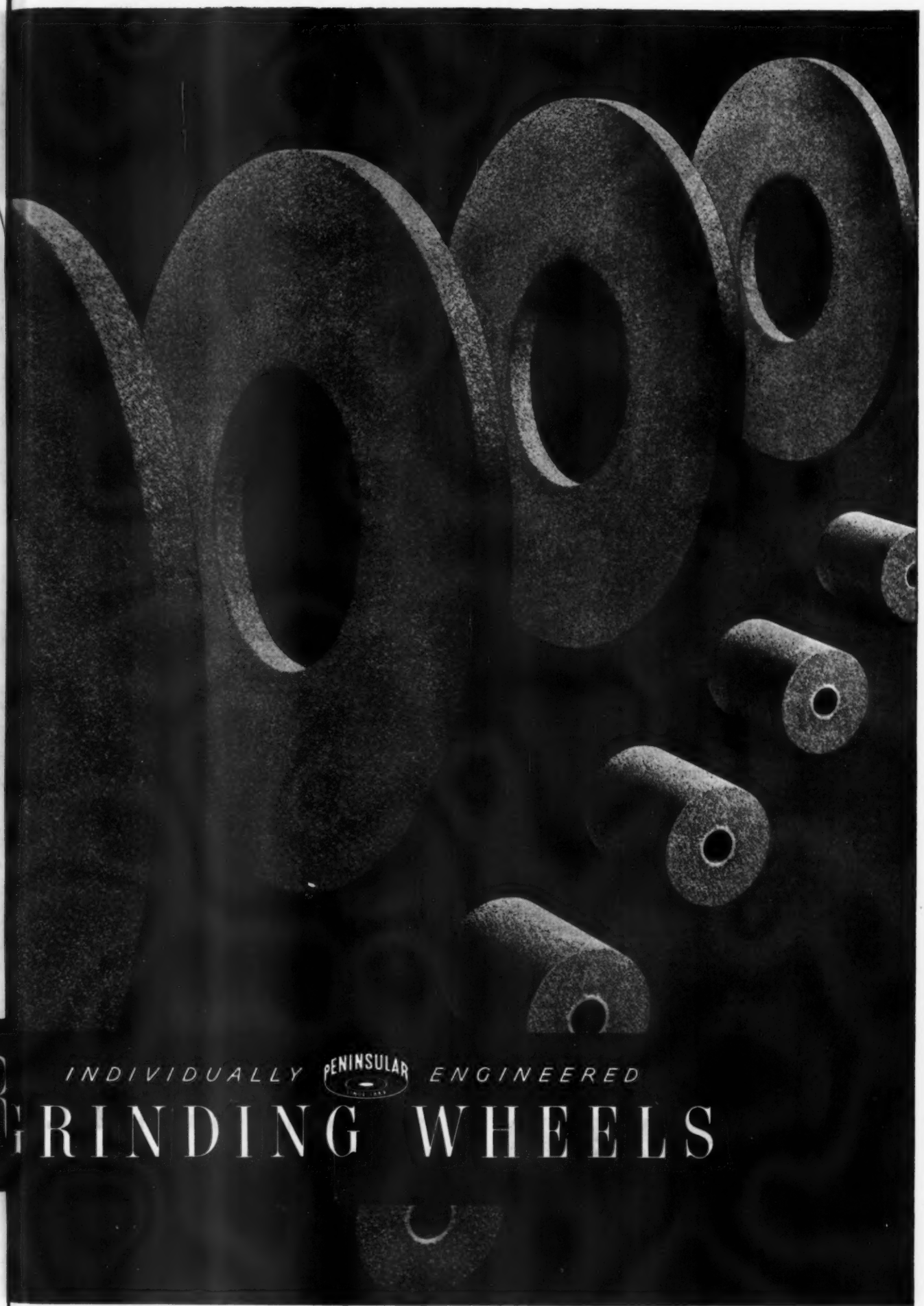
The Peninsular Grinding Wheel Company, 729 Meldrum Ave., Detroit 7, Mich. *Branches:* Chicago, Cleveland, Newark, Philadelphia, Pittsburgh.

SPECIALISTS IN RESINOID BONDED WHEELS

PENINSULAR

SINCE 1889

Types of Wheels for Rough Grinding


INDIVIDUALLY PENINSULAR ENGINEERED
GRINDING WHEELS

A NEW SUPERIOR SHAPER

20% LOWER IN PRICE

THE 20"
QUEEN CITY

Super Twenty Shaper

The 20" Queen City Super Twenty Shaper marks a great advance in shaper design and construction which enables us to sell this machine at a price 20% lower than any comparable make.

The following are just a few of the outstanding features of this remarkable new shaper: the ram is of the V-type of wide bearing; clutch is dry multiple-disc type; the feed range is extremely versatile—from .008" to .191", quickly and easily changed; a high torque motor for power rapid traverse is standard equipment; an electrical limit switch permits complete motor control; Timken bearings are used throughout.

For superior performance, low initial cost and upkeep, the Super Twenty is an outstanding value.

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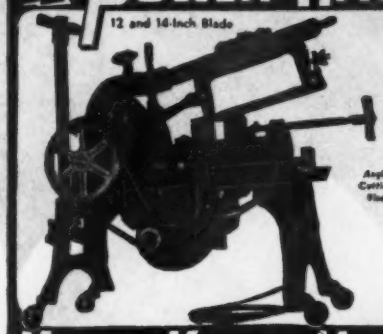
MACHINE TOOL Co.
217 E. SECOND ST.
CINCINNATI 2, OHIO

POWER HACK SAW



LOW PRICED
PORTABLE
SELF-CONTAINED
READY TO WORK
STURDY
ECONOMICAL
Write for Bulletin No. 100

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BUILT BY E. R. SEIFERT, INC.

AUTOMATIC...COMBINING SEVERAL OPERATIONS

This machine takes flat copper wire from reel . . . and through a series of automatic operations, including insertion of insulating paper between turns, ejects completely finished automobile starting motor field coils.

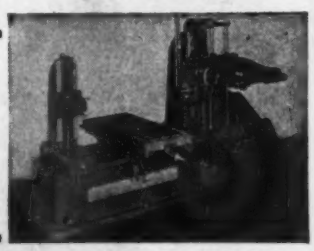
We review your special automatic wire forming or coil winding problems and offer standard machines in stock . . . or design special machines to your specifications.

E. R. SEIFERT, INC. 202-204 S. BEECH ST.
Syracuse 10, N. Y.

UNIVERSAL *Horizontal Boring Machine*

The only TRIWAY *Boring Machine Built*

Made in 3" and 4" spindle sizes. Write for complete, detailed specifications.



Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

HARDNESS TESTER

Let the SCLEROSCOPE speed up the production of that s so we can blow the Axis to HELL

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THE SHORE INSTRUMENT & MANUFACTURING CO., INC.
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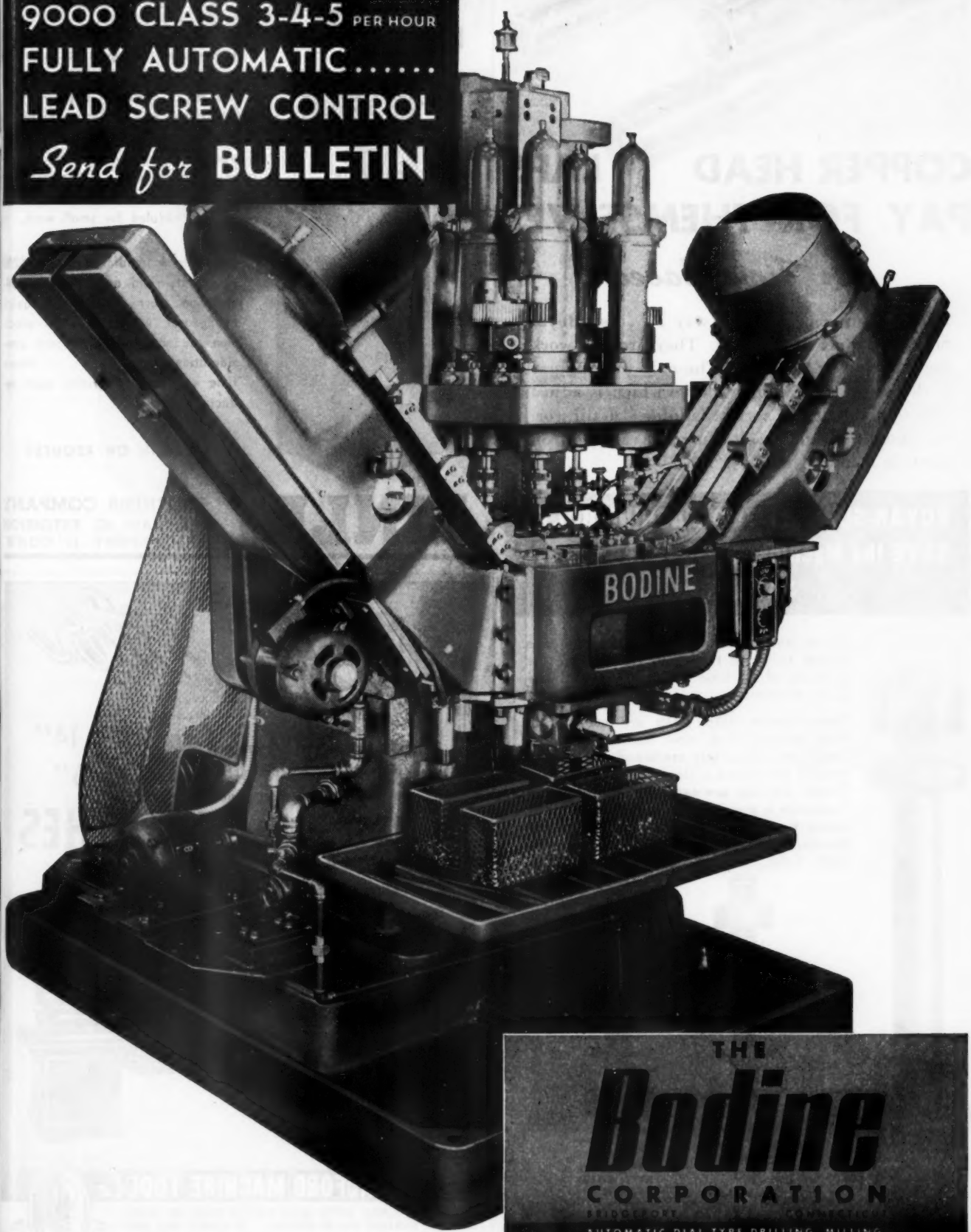
JAMAICA, NEW YORK
TELEPHONE: JAMAICA 6-4090

LAST WORD IN *Precision* NUT TAPPING

9000 CLASS 3-4-5 PER HOUR
FULLY AUTOMATIC.....
LEAD SCREW CONTROL
Send for BULLETIN



THE
Bodine
CORPORATION
BRIDGEPORT, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING
TAPPING AND SCREW INSERTING MACHINES

COPPER HEAD LAPS PAY FOR THEMSELVES

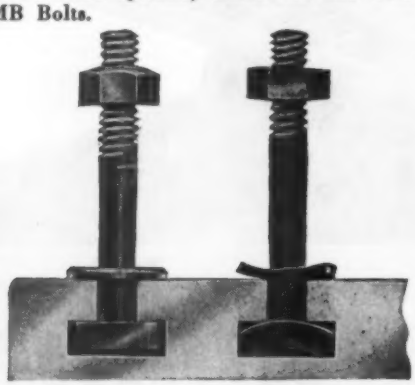
In Time Saved

Lap holes the economical way . . . use Boyar-Schultz Copper Head Laps. They are fast working; they never wear out. The only wearing part is the inexpensive copper sleeve which is adjustable to maintain the correct lapping size till worn out and a new one is substituted. Available from stock in standard sizes, 1/8" to 2 1/2".

BOYAR-SCHULTZ SMB MACHINE BOLTS
SAVE the Machine . . . SAVE the Job . . . SAVE Time

Worn and distorted Bolts like the one shown below at the right, can damage the accuracy of machine beds making costly repairs necessary.

Boyar-Schultz SMB Bolts are made from heat treated alloy steel for strength and toughness. Heads are machined square with bodies, presenting a clean flat surface to the T-slot. Threads are carefully cut. Close adjustments is possible and work is held firmly under heavy machine cuts. SMB Nuts and Washers are specially made for use with SMB Bolts.



SMB BOLTS FIT SQUARELY

WORN BOLTS DO NOT HOLD FIRMLY

BOYAR-SCHULTZ CORPORATION
2109 WALNUT STREET CHICAGO 12, ILL.

Fast, Accurate MILLING *and* JIG BORING

. . . The Linley machine has won the sincere approval of countless toolmakers for its ability to "keep the decks cleared" in busy shops. What it is now doing in war plants will be continued under civilian production later. It's a machine worthy of investigation . . . for relief of larger machines, too often expensively scheduled for small work.

. . . The 8 spindle speeds to 4250 r.p.m.; its rigid and compact construction, fast set-up and quick changeover, velvet feed and precision production . . . warrant consideration by any shop . . . insure time saving and definite cost reductions.

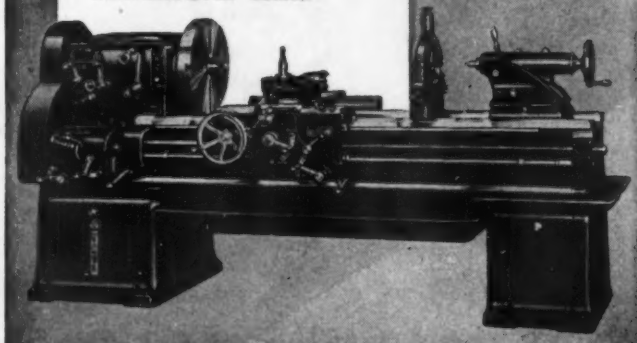
BULLETIN ON REQUEST

LINLEY BROTHERS COMPANY
664 STATE ST. EXTENSION
BRIDGEPORT 1, CONN.

Metalmaster

12", 14" & 16" LATHES

• Fast, accurate for war production . . . durably constructed, precision built to meet peacetime manufacturing needs. Write for catalogs describing in detail the advantages of METALMASTER Lathes.



The **BRADFORD MACHINE TOOL Co**

MANUFACTURERS OF METAL WORKING LATHES; CAM FEED DRILLING AND TAPPING EQUIPMENT, HYDRAULIC DRILLING MACHINES . . . IN BUSINESS SINCE 1840

659 EVANS AVE. . . . CINCINNATI, OHIO

With this New Clutch
YOU CAN SAVE

1. Space
2. Maintenance
3. Repair Cost
4. TIME

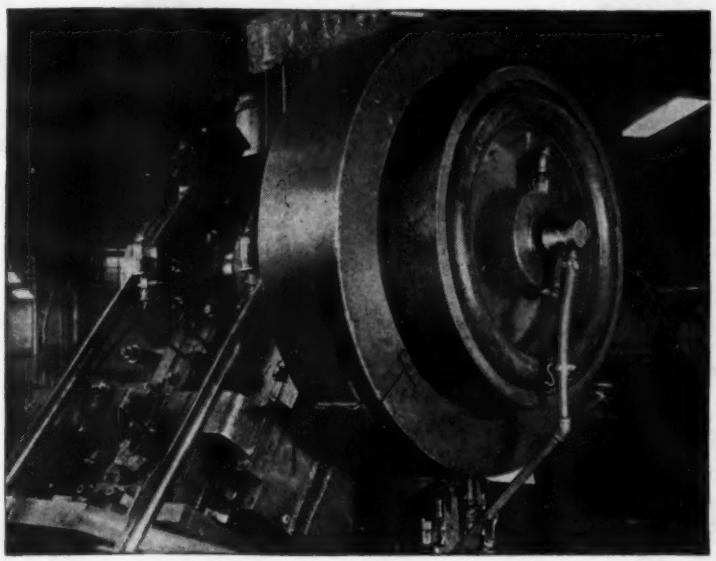
The FAWICK Airflex Clutch

1. **Saves Space because it is compact and requires no springs, arms or toggles. It controls power by air.**
2. **Saves Maintenance because it requires no adjustments, no lubrication. Even corrects automatically for misalignment.**
3. **Saves Repair Costs because there are no parts to break or wear out. Has torsional flexibility—absorbs shocks and vibration.**
4. **Saves TIME because it permits dependable *full-time* operation, in the heaviest service.**

• • •

The Fawick Airflex Clutch has proved its performance in hundreds of Naval vessels under combat conditions—and for heavy-duty drives throughout industry.

Ask our Engineering Department for recommendations.



The Fawick Airflex Clutch has demonstrated its performance and economy for all types of heavy machinery—especially presses and punch presses.

Acts as *both* clutch and brake.

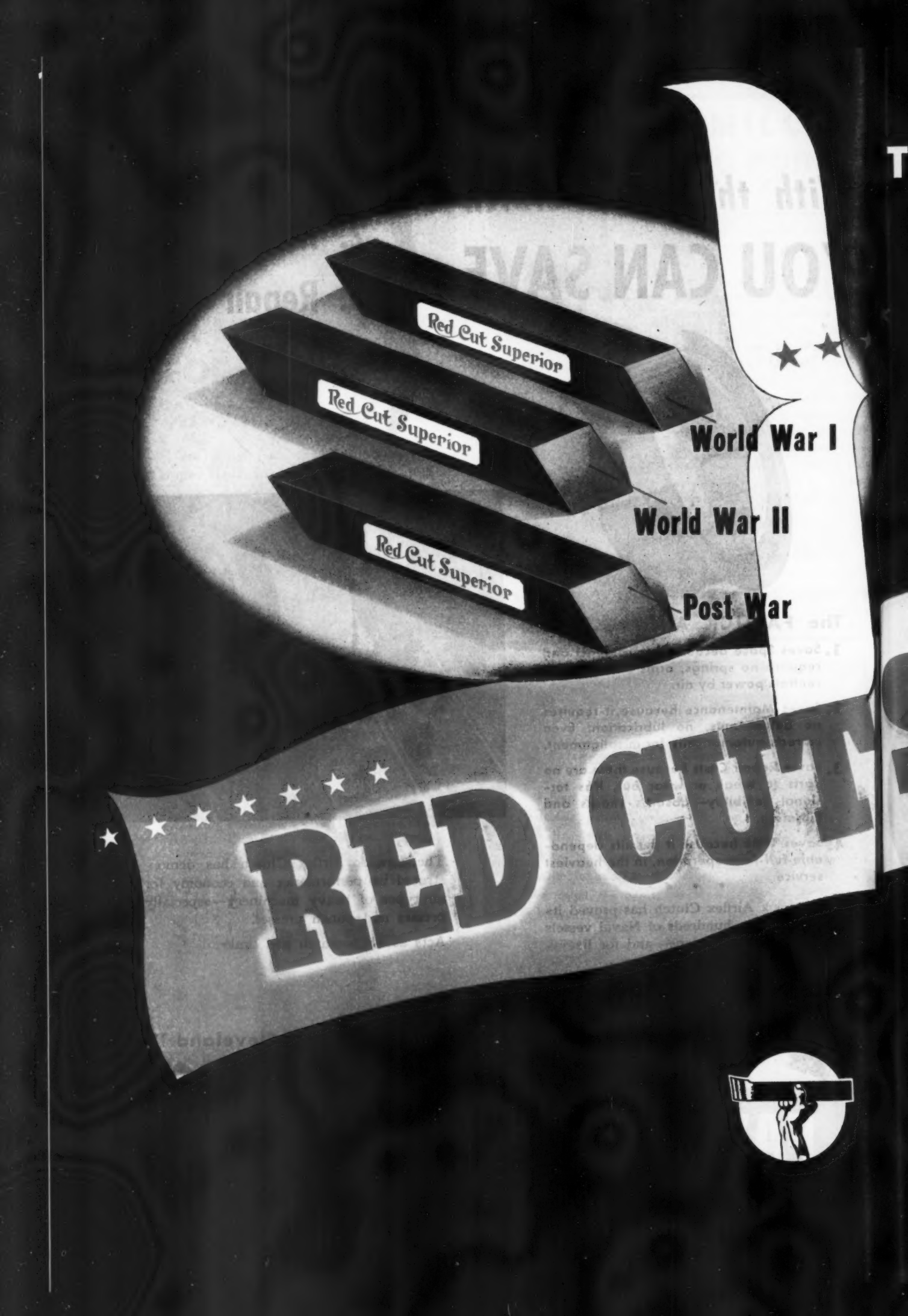
FAWICK AIRFLEX COMPANY, INC. • 9919 Clinton Rd., Cleveland 11, Ohio

***In Canada,* Renold-Coventry Ltd., Montreal, Toronto, Vancouver**

***In Britain,* Crofts Engineers, Ltd., Bradford, England**

FAWICK *Airflex* CLUTCH

POWER CONTROLLED BY AIR


Red Cut Superior
Red Cut Superior
Red Cut Superior
World War I
World War II
Post War
RED CUT

Through the years

America's most Versatile High Speed Steel

SUPERIOR

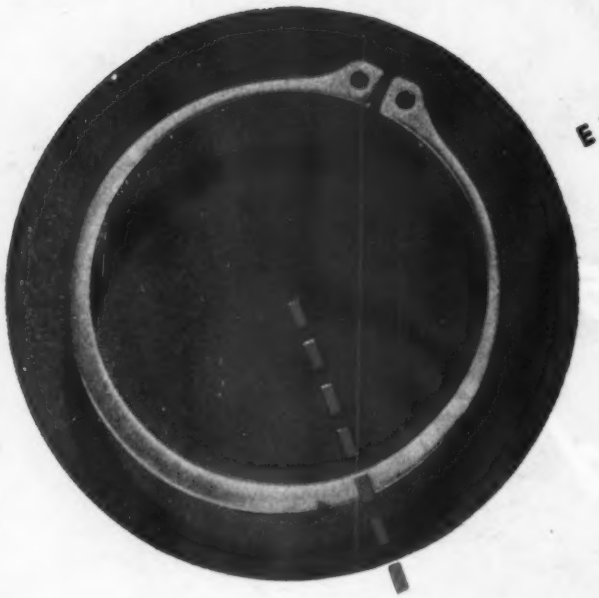
Time tested but up to the minute in balanced composition, Red Cut Superior continues to be the favorite high speed steel for general purpose work. The 18-4-1 type steel that eliminates heat treating problems and insures sound tools free from decarburization.

Red Cut Superior possesses high strength and toughness combined with red hardness to create maximum cutting efficiency. It moves least in hardening and is most stable after treatment.

Red Cut Superior is useful for many punch and die applications and for all cutting tools, including broaches, drills, reamers, taps, chasers, milling cutters, form cutters, hobs.

Vanadium-Alloys STEEL CO.

LATROBE, PA.



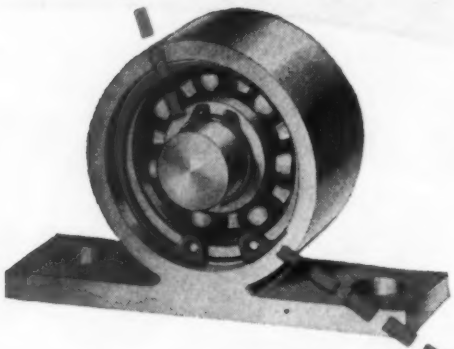
EXTERNAL TYPE NAS-51

WALDES

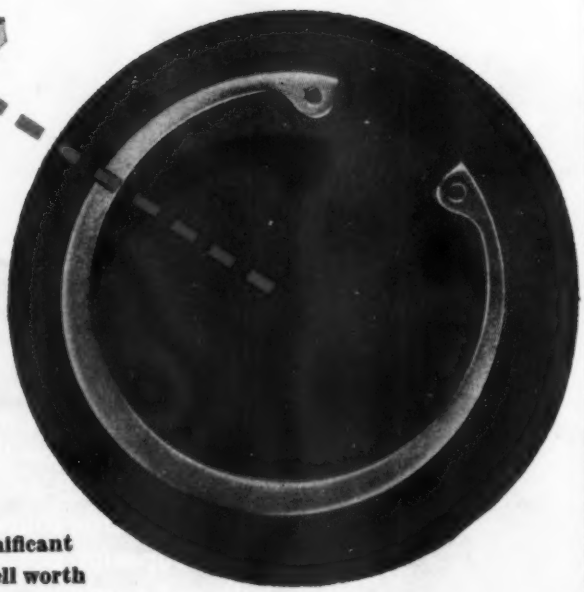
TRUARC

RETAINING RING

U. S. PATENT RE. 18,144

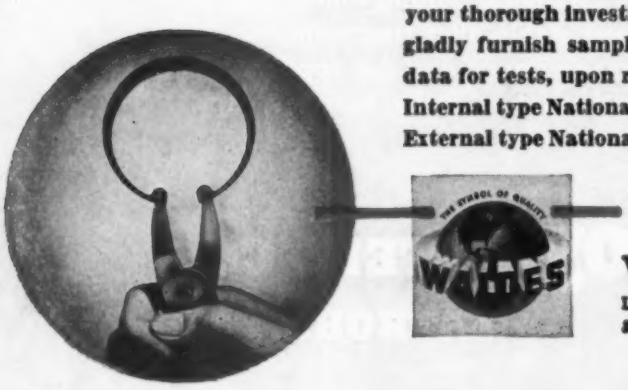


INTERNAL TYPE NAS-50



Waldes Truarc expands or contracts without distortion and without permanent set, fitting tight all around the groove. It offers important advantages over shoulders, nuts, collars, etc., for all thrust-load fixings in shaft and housing applications. It saves space, weight, assembly time and machining costs.

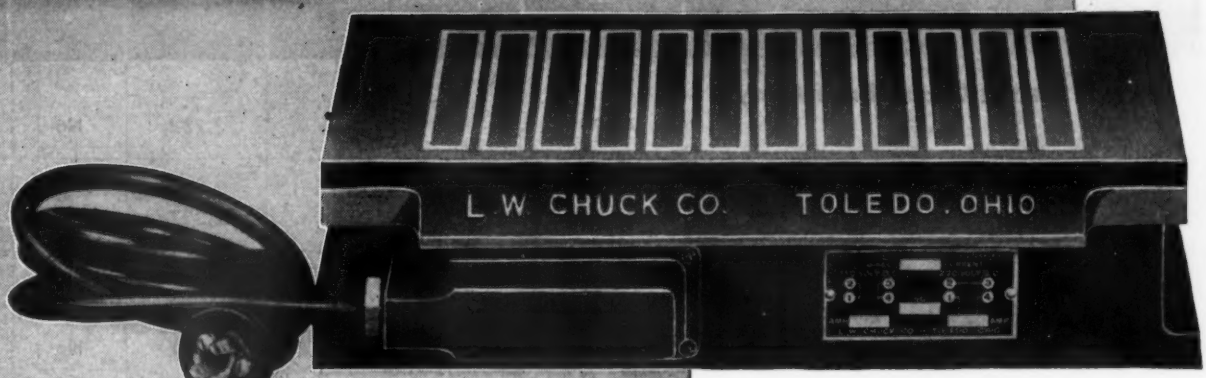
Waldes Truarc presents a significant advance in retaining rings, well worth your thorough investigation. We will gladly furnish samples and full data for tests, upon request.
Internal type National Aircraft Standard 50.
External type National Aircraft Standard 51.

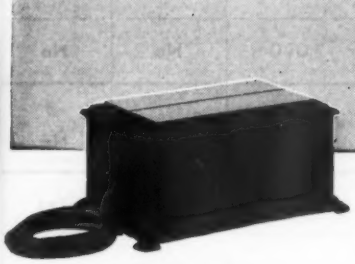


WALDES KOH-I-NOOR, INC.

Long Island City 1, N. Y. • Canadian Representatives: Prenco Progress & Engineering Corp., Ltd., 72-74 Stafford St., Toronto

L-W Magnetic Chucks





DEMAGNETIZERS

Model B-2 working surface 7¾" x 12½" x 6¾"....$63.20

Model J-1 working surface 7¼" x 7¼" x 6¾".....$41.15

RECTIFIERS

Converts A.C. into D.C. A.C. input 110 volts. D.C. output 110 volts, 8 amps. Suitable for use with our 5¾" x 13" and 6½" x 18" magnetic chucks. Price $38.75. Larger capacity rectifiers available.

DEMAGNETIZING SWITCHES

Field discharge type $16.25

L-W Demagnetizing Switch..... $8.90

● Guaranteed maximum holding power, constructed for long life, water-proof for wet or dry grinding. These plus-features combine with scientific design and highest grade materials to offer positive assurance that L-W Magnetic Chucks will meet all requirements and conditions. L-W supplies Magnetic Chucks in four sizes, equipped with connections to operate on either 110 or 220 volt D.C.

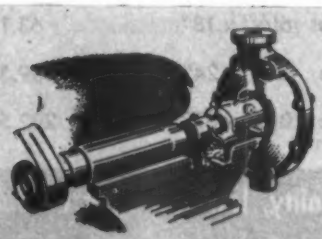
Size 5¾" x 13".....	$ 47.65
Size 6½" x 18".....	63.15
Size 8" x 24".....	109.30
Size 10¾" x 37"	202.50

Send for complete catalog giving prices and specifications on these quality, low-cost L-W Products

L-W CHUCK COMPANY 5 N. ST. CLAIR ST. TOLEDO 4, OHIO

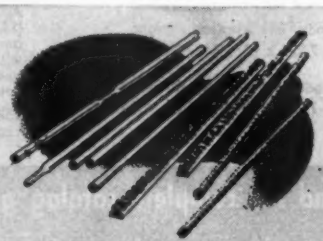
For the Tough Jobs use

Properties of HAYNES STELLITE Alloys	Average Tensile Strength, psi	Average Hardness, Rockwell	Melting Point, Deg. F	Can be Forged	Can be Rolled
HAYNES STELLITE Cobalt-Base Alloys					
1	47,000	C54	2,282	No	No
6 Cast	105,000	C40	2,327	Yes	Yes
Rolled	130,000	C40 to C46			
12	76,000	C48	2,306	No	No
Star J-Metal	65,000	C61	2,318	No	No
98M2	63,000	C62	2,250	No	No
HASTELLOY Nickel-Base Alloys					
B Cast	80,000	B96	2,440	Yes	Yes
Rolled	135,000	B98			
C Cast	76,000	B93	2,350	No	Yes
Rolled	120,000	B90			
D Cast	38,000	C53	2,040	No	No
HAYSTELLITE Tungsten-Base Alloys	—	Between 9 and 10 Moh's Scale	—	No	No
HASCROME Iron-Base Rod	40,000	C40-50 after peening	—	Yes	Yes



Castings . . . A wide range of castings can be supplied in:
HAYNES STELLITE Alloys 6, Star J-Metal, 98M2, 93
HASTELLOY Alloys B, C, D
HAYSTELLITE Tungsten-Base Alloys

Rolled Forms . . . Sheets and plates are made from:
HAYNES STELLITE Alloy 6
HASTELLOY Alloys B, C
Hot-rolled bars are supplied in:
HASTELLOY Alloy B



Welding Rods . . . for applying a wear- and corrosion-resistant alloy coating to other metals:
HAYNES STELLITE Alloys 1, 6, 12
HASTELLOY Alloys B, C, D
HAYSTELLITE Alloys
HASCROME Rod

HAYNES STELLITE Alloys

Resistance to Corrosion		
Oxidation at High Temp.	Sulphuric Acid	Hydrochloric Acid
Excellent	Fair	Fair
Excellent	Fair	Fair
Excellent	Fair	Fair
Excellent	Fair	Fair
Excellent	Fair	Fair
Fair	Good	Excellent
Excellent	Good	Good
Fair	Excellent	Fair
—	—	—
Fair	—	—

Available in a wide range of properties and forms to resist wear, corrosion, and heat . . .

HAYNES STELLITE alloys are specially made to meet the requirements of industry's most difficult applications. They are hard, tough, and heat-resistant and are used for those parts of equipment and machines that are most subject to wear and corrosion. The chart at the left describes some of these alloys and their significant properties. Sketched below are some of the forms in which they can be furnished.

For further information, write for the booklet, "Properties of HAYNES STELLITE Alloys."

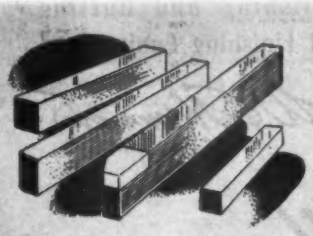
HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

General Office and Works, Kokomo, Ind.

Chicago—Cleveland—Detroit—Houston—Los Angeles—New York—San Francisco—Tulsa



Metal-Cutting Tools . . . made from HAYNES STELLITE Alloys, known for their red hardness. These tools take heavy cuts at high speeds and coarse feeds—with long life between grinds:

HAYNES STELLITE Star J-Metal
HAYNES STELLITE Alloy 98M2

HAYNES STELLITE TRADE-MARK

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BUY UNITED STATES WAR BONDS AND STAMPS

THERE'S A BARNES BAND SAW
FOR
EVERY BAND SAW OPERATION

Greater Chip Clearance

Enables you
to do faster, easier
sawing at high speeds

BARNES
Skip Tooth
BAND SAWS

Their greater chip clearance results in less heat generation, lengthened saw life, and prevents clogging of the teeth even at speeds of 2500 to 4500 S.F.M. This means faster, smoother, easier cutting of aluminum, soft brass, magnesium and other soft non-ferrous metals, plastics, compositions, fibre, wood, etc.

In addition, Barnes Skip Tooth Band Saws—even in the narrower widths—are so designed as to provide increased body strength. Economical—for they stay sharp longer, usable until thoroughly worn out. You save resharpening costs . . . expensive machine "down-time" for blade change is lessened. Learn today how the Barnes Skip Tooth can increase the efficiency of your sawing operations. Available in widths of ¼" to 1", and in 2, 3, 4, and 6 teeth per inch.

★ Call your Distributor for full details and prompt delivery of the Barnes Skip Tooth as well as other Barnes Band Saws and Hack Saw Blades.

ESTABLISHED 1919
W. O. BARNES CO., INC.
DETROIT 14, MICHIGAN

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OF KALAMAZOO

New Methods-
New Machines

Certainly, yes is the answer. We've been keeping in the forefront of finishing equipment development for many years and we will have new postwar tools for you, but everyone of them will have been tested in the crucible of practical use.

You are entitled to this assurance and you can rely upon it. Hammond builds a complete line of Carbide • Abrasive Belt and Wheel Grinders • Polishing and Buffing Lathes • Automatic Polishing and Buffing • Cylindrical Finishing Equipment.

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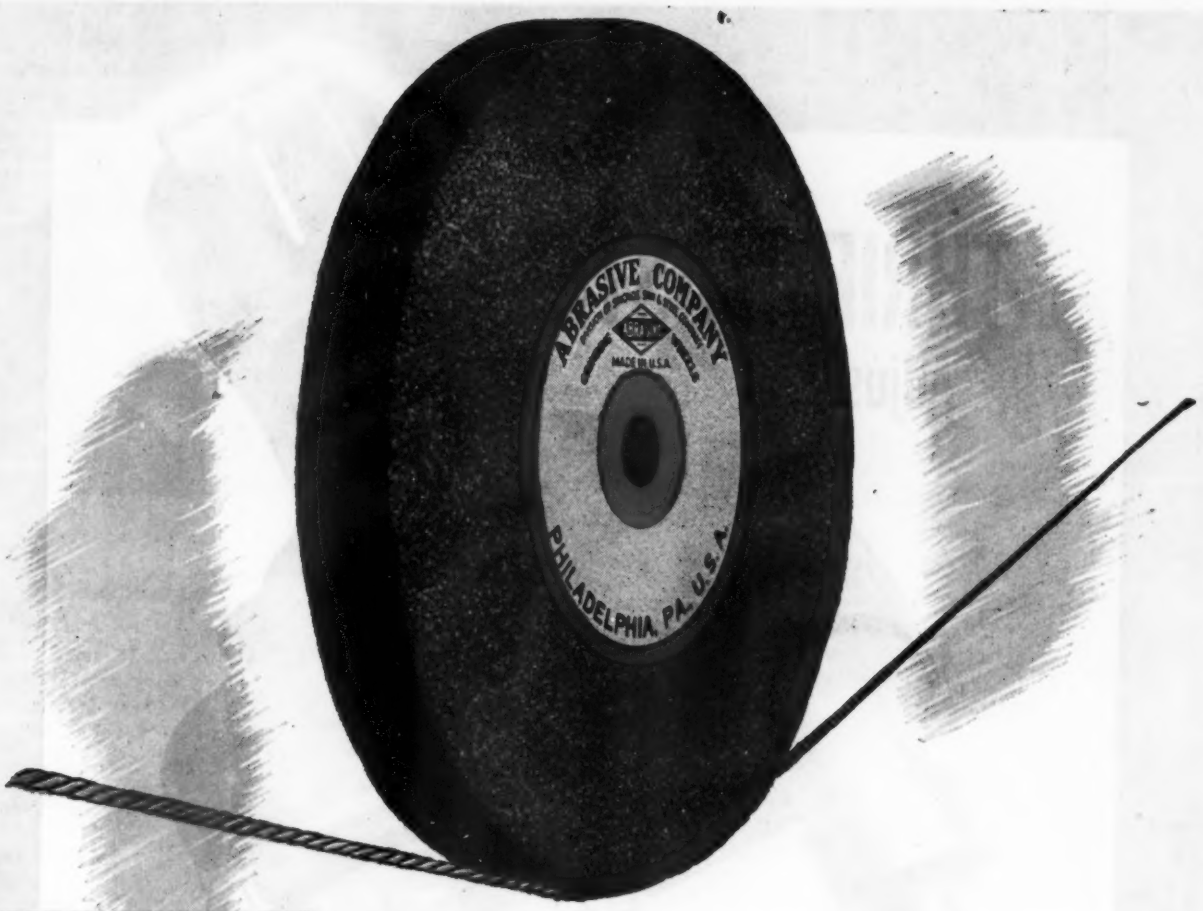
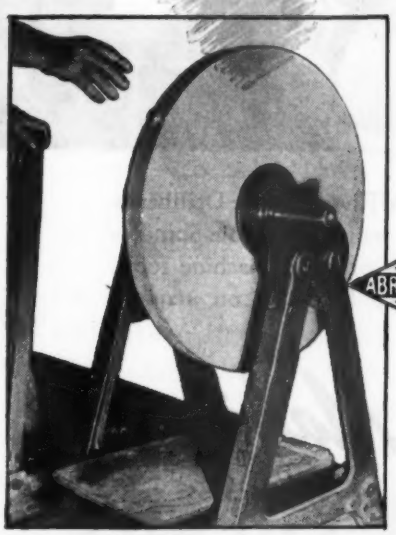
Eastern Branch: 71 W. 23rd St., New York 10, N.Y.



BALANCE



Sensitive balancing ways are used to make certain of the accuracy of Abrasive Company Grinding Wheels.

Balance might be the one word to describe Abrasive Company excellence. Mechanical balance is essential for efficient grinding and is a "must" in every Borolon and Electrolon Grinding Wheel. Balance prevents vibration and chattering; and lengthens the life of valuable grinding machinery. Balance starts with selection of raw material, and the manufacture of abrasive grains. Hundreds of balanced formulas produce just the right bond for many combinations of grade and density. Balanced control of molding processes; balanced regulation of kiln heats and operation; balance in the finishing; and balance in tests and inspections are all basic to quality in Abrasive Company manufacturing.

Balanced inventories in factory stock and on distributors' shelves make Abrasive Electrolon and Borolon Grinding Wheels; Segments; Mounted Wheels and Points; Grains, Bricks, and Sticks available for your every specific abrasive requirement.

abrasive Company

Division of Simonds Saw and Steel Company

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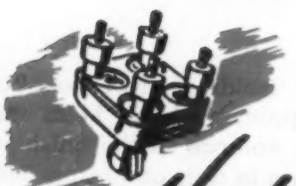
THRIFTMASTER
Adjustable



THRIFTMASTER ***Adjustable*** **Drillheads with 2 or more Adjustable Spindles are highly practical machine tools. Descriptive brochure on request.**

High Production - Money Making
MULTIPLE SPINDLE DRILLHEADS

THRIFTMASTER PRODUCTS

Division of

THOMSON INDUSTRIES, INC.

29-05 Review Avenue · Long Island City 1 · New York

In the making

Illustrating how ALX Cast Alloy Tool Bits are poured on a centrifugal spinner. The metal is weighed first to assure filling the mold without insufficiency or waste.

On the job

A 7/16" ALX Tool Bit rough-turning a Type 309 (25-12) stainless steel forging of 4-1/4" diameter, taking a 1/8" cut at a speed of 140 feet per minute, with a feed of .020".

Announcing ALX CAST ALLOY TOOL BITS — FAST CUTTING NON FERROUS TOOL BITS CONTAINING BORON

OUR most recent development in the field of cutting materials, ALX Cast Alloy Tool Bits, is the result of complete and thorough research investigation in the Allegheny Ludlum Laboratories, and exhaustive machining tests in the field.

Produced by advanced methods of centrifugal casting, ALX Alloy is a highly homogenous metal, with consequent advantage in cutting properties. It possesses high hardness in the as-cast condition, requiring no further heat treatment. In performance, ALX rates between carbide metal-tipped tools and high speed steel. It rounds out and completes the Allegheny Ludlum line of cutting materials—which includes Carmet carbide metals and a wide selection of high and low-tungsten and "moly" high speed steels—giving us the utmost range in supplying the tools best fitted for each individual job.

Ground and finished ALX Cast Alloy Tools, both in solid and tipped bits, are available in a complete range of sizes from our own and distributors' warehouse stocks. They fully merit serious investigation and comparative testing on your cutting jobs. The assistance of our Mill Service Staff is at your entire disposal • Also available is a new and complete bulletin on ALX Tool Bits, giving full data on selection and performance. *Write for your copy.*

Address Dept. A.M.-37

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

W & D...9795

LUBRIPLATE No. 205

MAKE ONE BEARING OUTLIVE TWO

LUBRIPLATE No. 205 is a lubricant developed for use in grease type anti-friction bearings operating at speeds from 5000 RPM to 20,000 RPM. Users of high speed machinery tell us that this remarkable lubricant often more than doubles the life of bearings. For the lubrication of anti-friction bearings with oil type housings LUBRIPLATE No. 1 or No. 2 is recommended depending upon the operating speed.

℞ FOR YOUR MACHINERY

No. 3—Ideal for general oil type lubrication. Ring oiled bearings, wick feeds, sight feeds and bottle oilers.

No. 2—Because of its high film strength and long life reflects outstanding performance in most types of enclosed gears (speed reducers).

No. 107—One of the most popular grease type products for general application by pressure gun or cups.

No. 70—For a wide range of grease applications, especially at temperatures above 200 degrees F.

No. 130-AA—Known nationwide as the superior lubricant for open gears, heavy duty bearings, wire rope, etc.

BALL BEARING—This is the LUBRIPLATE lubricant that has achieved wide acclaim for use in the general run of ball and roller bearings operating at speeds to 5000 RPM and temperatures up to 300 degrees F.

Write for a booklet, "The LUBRIPLATE Film", written especially for your industry.

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1870 - 1945
DEALERS FROM COAST TO COAST

HOBART's "Practical Design for Arc Welding"

Arc Welding has made possible most of the phenomenal records established in war production. That's why Hobart offers these design and redesign sheets to help you with your post-war metal joining problems. Change to welded design for a better, more competitive product at lower costs.

FREE! First releases are sent immediately upon request! Write for yours today!

The Universally used Hobart "Simplified" Arc Welder together with these redesign sheets are an unbeatable combination for solving your metal joining problems. PROMPT DELIVERIES on all priority rated orders.

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HOBART
"One of the World's Largest Builders of Arc Welders"

IMMEDIATE DELIVERY

No. 1 to 60 New High Speed Long Length DRILLS

No. by Gage	Length	Our Price Net Each
1 to 10	6¼	$ .75
11 to 20	5¾	.75
21 to 30	5⅜	.75
31 to 40	5¼	.75
41 to 50	4½	.75
51 to 60	4¼	.75

If you buy 60 drills or more — 20% discount

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251 CENTER STREET
NEW YORK N. Y.

SAYS THE MAN IN THE HELMET—

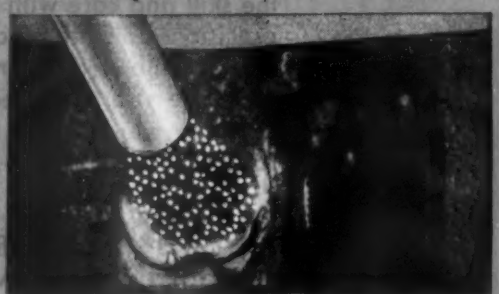
"For flat, smooth fillets on vertical and overhead welds, you can't beat AIRCO No. 230 Electrode . . . .

AWS Classification E 6011

". . . It's tops in the field for all-position AC welding.

"I like the neat, smooth fillets it gives on vertical and overhead welding. They're unusually strong, deep welds, too — good enough to meet the strictest code requirements.

"The metal sets up rapidly, which is one of the reasons why this Airco No. 230 is an especially fine electrode for making vertical and overhead welds.



"Slag doesn't interfere and the fine spraying action and lack of arc-blow help out greatly, too.

"I use it on AC or DC. It's mainly a grand all-position AC electrode, but it works fine with DC reverse polarity, too. It's easy to identify by this A.W.S. color marking — white end and blue band. Conforms to A.W.S. Classification E6011."

Airco electrodes are made in a complete range of types and sizes for every welding job. The new catalog describes Airco's complete line.

For a free copy of Airco's News Electrode Catalogue No. 120 write to the local Airco office or to Dept. AM. Address Air Reduction, General Offices: 60 East 42nd St., New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, General Offices: Houston 1, Texas.

Weld with **AIR REDUCTION**
Offices in All Principal Cities

AIRCO ELECTRODES FOR BETTER WELDS AND EASIER WELDING

You get these advantages

when you buy

VICTOR HACK SAW BLADES

Complete metal cutting instructions are given in this FREE VICTOR Metal Cutting Handbook. Send for a copy today.

VICTOR

VICTOR SAW WORKS, INC.
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Makers of hand and power hack saw blades, frames and metal cutting band saw blades.

3 SPEED IN YOUR FILING OPERATIONS

3rd of a series describing how "AMERICAN SWISS" Files improve filing operations

"AMERICAN SWISS" Swiss-Pattern Files speed up filing operations because of their specially keen filing edges . . . their exceptionally large filing surface . . . their thorough and uniform hardness.

Many an enthusiastic user has told us that "AMERICAN SWISS" Files outfile all other makes they have tried. This is the natural result of the skill and care with which these precision tools are made by Swiss-Pattern file craftsmen, and the forty-five years of specialized experience which guide their manufacture.

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AMERICAN SWISS FILE & TOOL CO.
ELIZABETH 1, N. J.

ASK FOR THEM BY NAME

American Swiss

SWISS PATTERN FILES

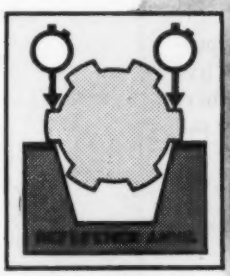
A GAGE BUILT-TO-FIT YOUR PARTICULAR NEED

Would be . . .

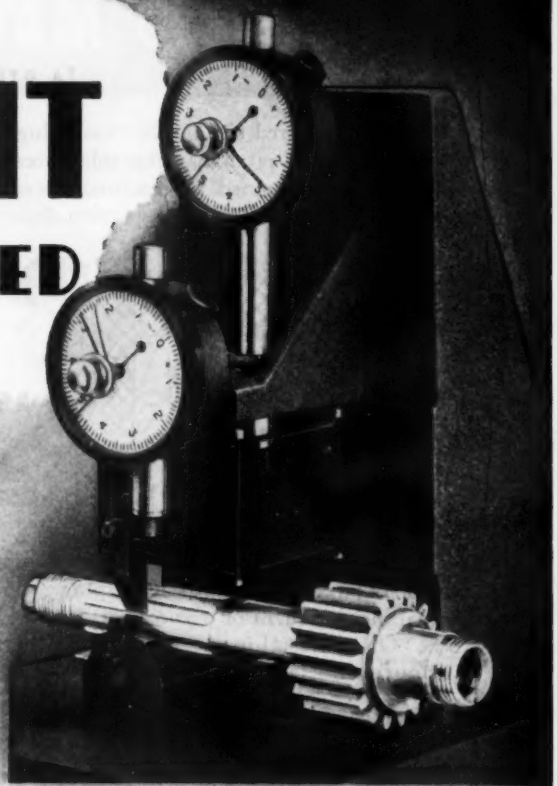
Faster
More Convenient
More Accurate
More Economical

As For Instance...

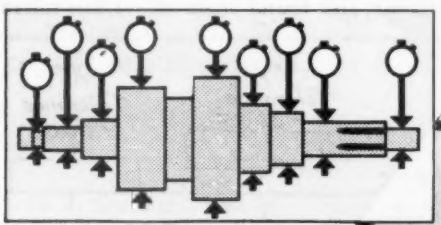
SPLINES — Two splines, instead of only one, are inspected simultaneously with this Gage. Moreover, each spline is easily checked throughout its length to determine uniformity of width. Proper spacing of the splines could also be inspected in a similar manner.



Two simultaneous inspections save time.

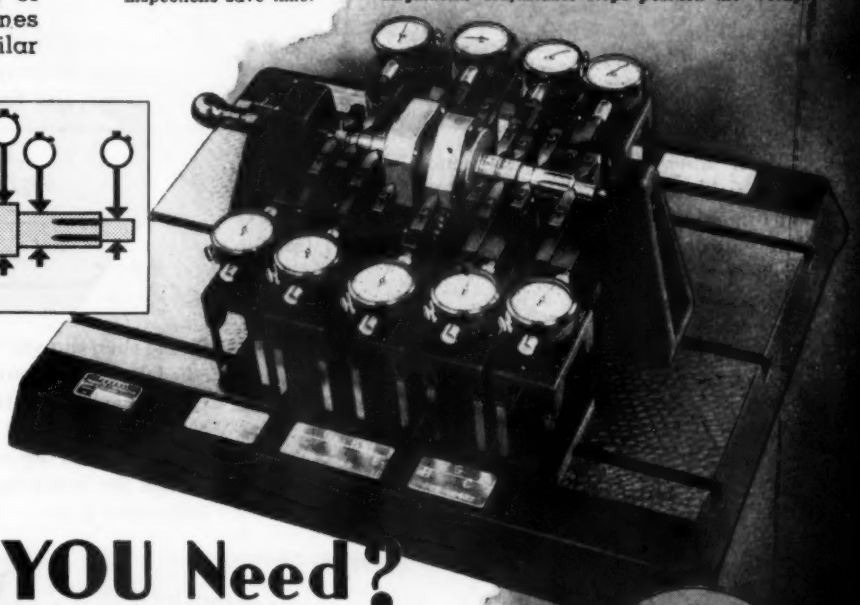


MODEL 259 B-67 — Splined shaft is supported for alignment. Adjustable stops position the workpiece.



MODEL 236 B-123

SHAFTS—This Gage is adjustable to take different diameters, and different lengths. Work is easily inserted between centers.



Or..What do YOU Need?

Give your requirements to our representatives or send them to our sales engineering department

We Have Designed and Built Thousands of Gages to Fit Specific Requirements

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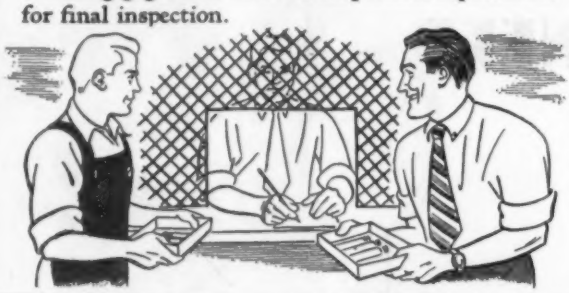
★ ★ ★ ★ ★ **FEDERAL** ★ ★ ★ ★ ★

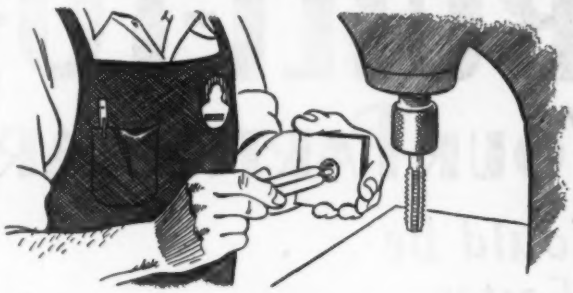
PRECISION MEASURING INSTRUMENTS

NOTHING WRONG WITH "REJECTED" PARTS? "GREENFIELD MAN" SOLVES GAGING MYSTERY

[A GTD SHOW-HOW REPORT]

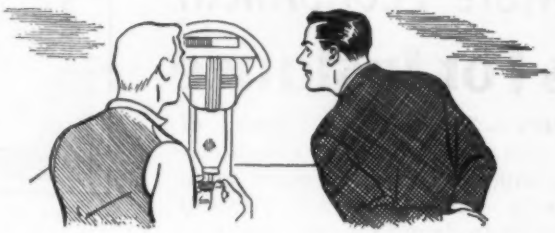
1 Customer ordered six 1/2-20 "Go" plug thread gages made to "X" pitch diameter tolerances. Three of them were assigned to machine operators as working gages and three to inspection department for final inspection.





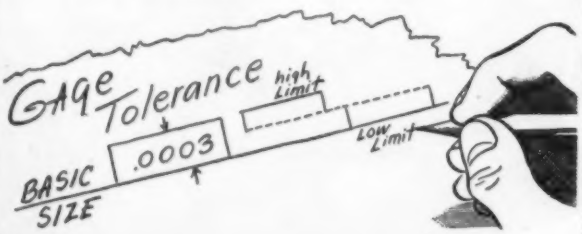
2 At tapping job the machine operators used working gages to check each part before they went on to next operation.

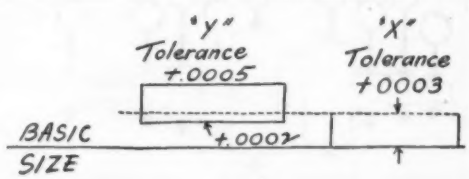
3 But at the final inspection of part, a large proportion of pieces failed to pass "Go" plug gage. Why? Actual measurement of rejected parts showed them to be "OK". Something was wrong. A hurry call was put in for "Greenfield Man".



4 On arrival at plant, "Greenfield Man" first had all six gages measured in customer's own inspection department, and found them all within tolerance.

5 "I'll show you what happened," said "The Greenfield Man". "Although all six gages were within specified limits, some were on the 'high side' and some on 'low side'. Thus high limit gages failed to enter where low limit gages would."





6 He then showed how this problem could be remedied by: 1. Measuring all gages and distributing those that tended to the "high limit" to machine operators and those tending to the "low limit" to the inspection department. 2. By ordering "Y" tolerance for working gages, and "X" tolerance for inspection gages.

Results: (1) Customer learned that trouble was not with gages he ordered, but with their application to the job. (2) Was able to establish proper gage ordering and handling procedures.

"Greenfield" SHOW-HOW is KNOW-HOW in action!

ON THREADING PROBLEMS SIMPLY CALL YOUR "GREENFIELD MAN" THROUGH YOUR "GREENFIELD" DISTRIBUTOR!

GREENFIELD TAP and DIE CORPORATION
GREENFIELD · MASSACHUSETTS

There's a correct S/V Sova-Kote to meet your specific requirements. Stop Rust Before It Starts!

LIKE a thief in the night, rust attacks the products of your plant. It's an ever-present threat to unfinished parts between operations. It goes to work on finished parts in transit and in storage.

The best way to guard against this threat is to make sure that you have a proved rust preventive suited to your particular needs.

No matter what your requirements may be—indoor or outdoor protection, simple or intricate parts, light or heavy-duty service, hot or cold application—you'll find the correct answer in the complete S/V Sova-Kote line. For this line includes outstanding products developed to solve all current rust prevention problems.

On your request, your Socony-Vacuum Representative will study your special needs and help you select and apply the best possible rust protection. Why not get his expert advice and stop rust on your products before it starts?

SOCONY-VACUUM OIL CO., INC.
Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. • White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of California.

GARGOYLE Lubricants

SOCONY-VACUUM'S 5 Steps to Lower Production Costs:

1. Lubrication Study of Your Entire Plant
2. Lubrication Schedules and Controls
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4. Skilled Engineering Counsel
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TUNE IN "INFORMATION PLEASE"—MONDAY EVENINGS, 9:30 E.W.T.—NBC

Today machine shops must be equipped to grind odd-shaped forms. To do this precisely requires dressing the abrasive wheel to the desired contour. No. 41 does that, accurately, quickly.

DELIVERIES IMMEDIATE

At Last It's Possible!

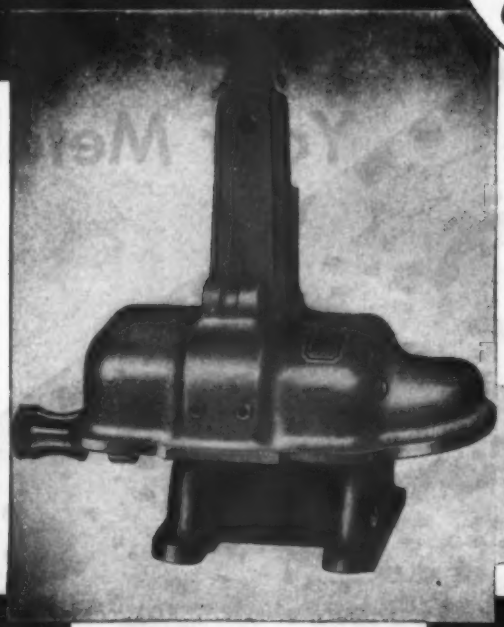
Introducing No. 41 Contour, Radius and Angle Dresser

Now Even the Operator of Limited Experience Can Dress and Re-dress

ABRASIVE WHEELS

Accurately and Quickly to

ANY CONTOUR!



No. 41-B Template Dresser. Rear View.

Plus regular radius and angle Dressing

Virtually any desired contour can be generated on abrasive wheels by placing a template of the curve in the clamp of No. 41-B. A spring-activated plunger follows the contour of the template as the operator simply turns the knob. As he turns it, the chisel pointed diamond of the dresser moves across the face of the rotating abrasive wheel, dressing it exactly to the shape of the template.

Flexibility, accessibility of parts for cleaning, and simplicity are among the features of No. 41-A Radius and Angle Dresser made possible by expert engineering design.

With its base, No. 41-A does all the usual jobs of a quality radius and angle dresser. Yet its cost is remarkably low.

No. 41-A Radius and Angle Dresser. Front View.

After the wheel is dressed by the chisel-pointed diamond, it fits the template accurately. When worn, it is quickly re-dressed to the same contour.

Write for Booklet D

BEST TOOLS CORPORATION

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INGENIOUS NEW PRINCIPLE "O-P" MULTIFLEX COUPLINGS

THREE UNIT SAFETY SMOOTH DESIGN

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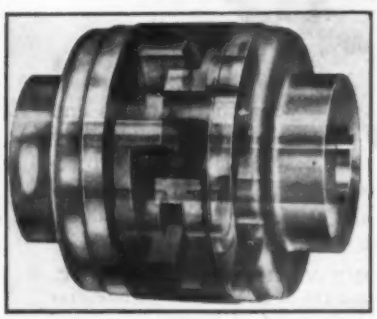

Today — and in the tomorrow — the transmission of power is a vital factor. MULTIFLEX COUPLINGS were designed to transmit that power under all conditions. MULTIFLEX COUPLINGS give greater MULTIFLEXIBILITY against heavy shock and pulsating loads in any direction, also compensating for ANGULAR AND PARALLEL MISALIGNMENT. So — for insured production order MULTIFLEX COUPLINGS.

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Insures

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. . for over 70 years

ALMOND THREE-JAW DRILL CHUCKS—the first to be placed on the market more than seventy years ago—pioneered the field of drill chucks. During all these many years, ALMOND CHUCKS have continued to be a necessary part in the logical procedure of machine developments.

Made in types and sizes to fit all machine tools and portable drills.

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You get spindle lubrication off your mind when you use

POPE Precision Spindles with lubrication SEALED-IN

The Spindle is the heart of the machine. That's why it's especially important to keep it running smoothly and with undiminished efficiency month in and month out.

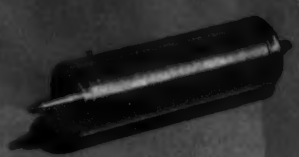
POPE Spindles require no attention for lubrication or adjustment. They have no oil cups, wicks or grease fittings for you to look after — the lubricant is sealed-in — good for the life of the bearings. Dirt and dust can't get in, lubricant can't get out.

Sealed-in lubrication is but one of the features that make it pay to standardize on POPE Spindles.

Simply send us a description with sketch or outlined drawing. Then leave it to us to provide a POPE Spindle designed for your work.

This POPE Motorized Surface Grinder Spindle is an excellent example of the advantages of *sealed-in* construction. The motor as well as the spindle itself is completely sealed in. No chance for dust and dirt to cause damage to either motor or bearings.

This POPE Vertical Motorized Spindle with sealed lubrication comes in a variety of powers and speeds for use on surface grinders and many other machines.



This POPE Tool and Cutter Grinder Spindle is a neat, self-contained package — sealed lubrication, cool running, long-lived, requiring no attention.

This POPE Spindle is of the cartridge type, flange mounted in a heavy housing. It is used as a head-stock spindle on special purpose, high production lathes. The lubrication is sealed in.

No. 22

POPE

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POPE MACHINERY CORPORATION

ESTABLISHED 1920

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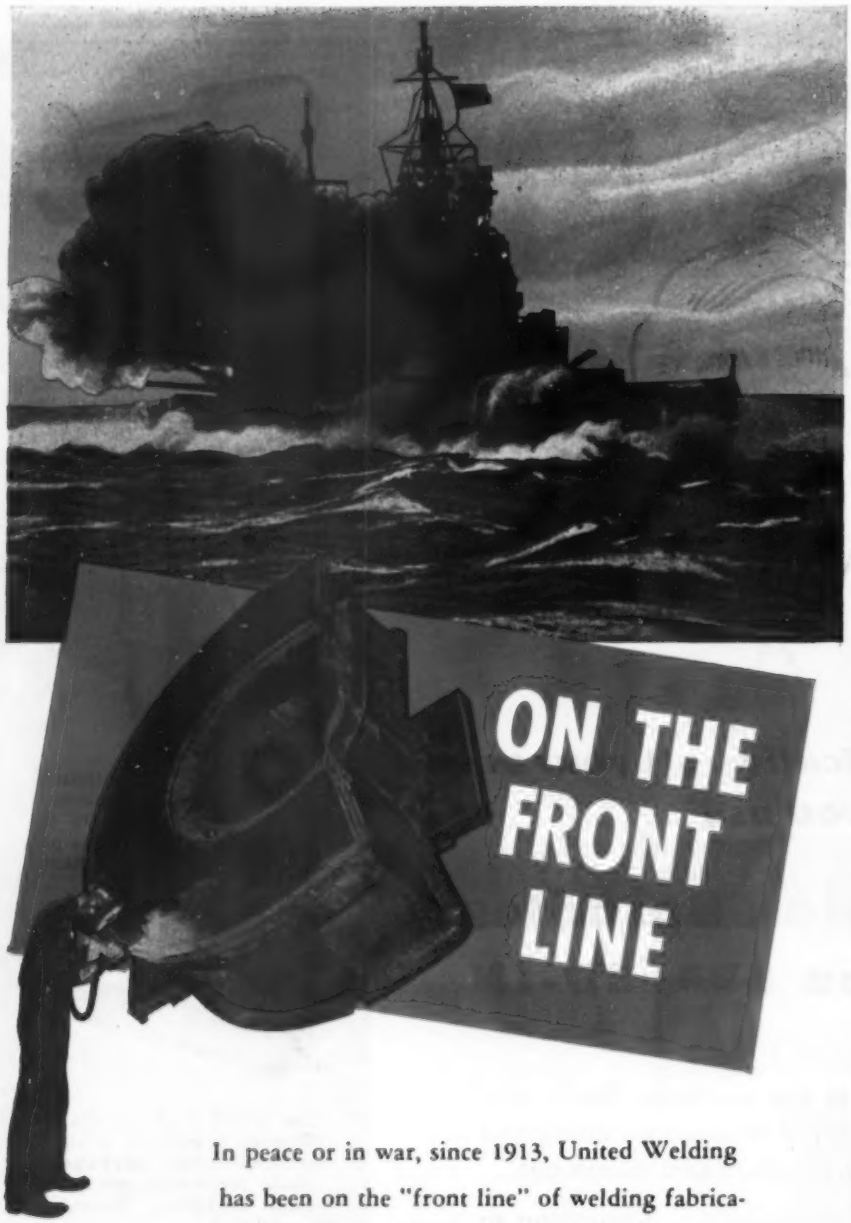
BUILDERS OF PRECISION SPINDLES



In peace or in war, since 1913, United Welding has been on the "front line" of welding fabrication. With their excellent equipment, experienced engineers and 32 years of background, United is well qualified to "meet and conquer" any fabricated welding problem.

Whether your weldments are complete products or only parts thereof, whether they are large, small or complicated, they can be produced at United rapidly and economically.

United's engineers are available for consultation. Write them today. Quotations upon request.

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THE UNITED WELDING CO.
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WELDING FABRICATORS OF MODERN DESIGNS
SINCE 1913

SIMPLE

WILLSON No. 5 and 45 Lightweight Respirators with easily replaceable filters protect workers. They remove harmful dusts and mists. Bureau of Mines Approvals for various hazards. Filters tested for low breathing resistance.

SAFE

Two sizes for wide range of faces assure safety of a good fit. Form molded rubber facepiece prevents leakage at edges. Adjustable headband and nose spring maintain tight seal.

COMFORTABLE

Comfort features of WILLSON Respirators make them easy to wear. Their light weight requires little headband pressure. Compactness permits full vision—safety goggles can be worn. Washable cotton FACELET* protects face.

*Trade Mark Reg. U. S. Pat. Off.

Get in touch with your WILLSON *Safety Service Distributor for full information. Or write Dept. AM-6.*

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON
PRODUCTS INCORPORATED
READING, PA. U.S.A.

How a Disstoneer solved the case of the teakwood cutter

A manufacturer received an order for tongue and groove flooring made of teakwood, a highly abrasive wood that is difficult to work. High-speed knives were used, but they wore down so fast that regrinding every 15 minutes was necessary. Production between grinds amounted to only 1200 linear feet; and in order to assure satisfactory workmanship, an inspector had to be kept on the job.

The Disstoneer* called in to study this problem, recommended the use of knives tipped with Carboloy, the "hardest metal made by man." The Carboloy knives ran 20 hours before grinding was needed (80 times as long as the other knives), 100,000 linear feet of flooring was produced, and cutting was so accurate that the inspector was no longer needed.

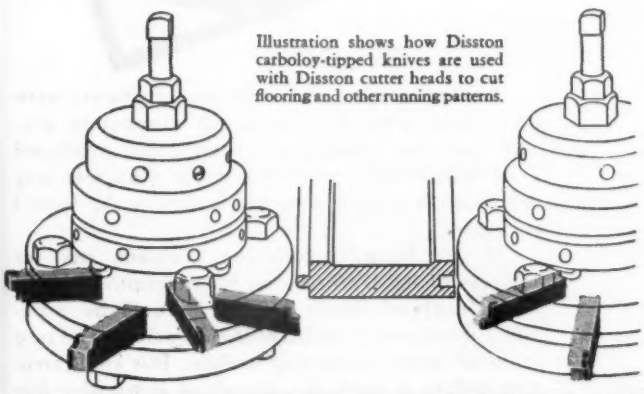

Illustration shows how Disston carboloy-tipped knives are used with Disston cutter heads to cut flooring and other running patterns.

Another clear-cut case of Disston leadership!

***DISSTONEER . . .** a man who combines the leadership and experience of Disston with sound engineering knowledge, to find the *right tool* for you—to cut metal, to cut wood and other materials—and TO CUT YOUR COST OF PRODUCTION—*not only on difficult work, but on simpler jobs as well.*

YOUR cutting problems may be vastly different, but if they have to do with metals, you will be interested in—

DISSTON METAL CUTTING BAND SAWS

Made of tough, durable Disston steel, in two types: (1) *Hardened Throughout*, for high-speed cutting of thin sheet steel, aluminum, plastics, etc., regular or pullman teeth; and (2) *Hard Edge Flexible Back* for low speeds on all materials adaptable to metal cutting band saws; three different sets—Straight, Raker and Group. Disston Metal Cutting Band Saws are made to fit different makes of machines.

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Do you have to

LAY OUT REMOTE CONTROLS

in Congested Areas?

If you do, the answer to your troubles may be found in this

FREE BOOK

Besides holding the key to many knotty problems of remote control installations, "The How and Why of Flexible Shafting" also shows simple ways to handle power transmission off-center and around obstructions. The book is factual, full of diagrams, and well worth your attention. Ask for your FREE copy today.

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Please send me a copy of your book, "The How and Why of Flexible Shafting."

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INDUWRAP

Airplane engine and parts manufacturers were up against it for a greaseproof wrapper to prevent corrosion. Angier of Framingham produced it in INDUWRAP, which has more than met any specification ever drawn for a Grade A, Type I wrapper.

If you have a *corrosion* problem, ask for samples of INDUWRAP and for descriptive folder, "The Touch of Death to Steel." You'll be especially interested in INDUWRAP'S exclusive infused *Inhibitor* metal-contacting surface. This kills corrosion before it starts by depositing a transfer film on the exposed metal spots, often caused by breaks in the protective oil film.

Other important features are that INDUWRAP is creped to S-T-R-E-T-C-H. It lets packaged metal breathe. It is soft and pliable, molding easily to hug odd-shaped articles snugly — without rupturing. Investigate INDUWRAP.

In writing for samples and literature, please mention AMERICAN MACHINIST.

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ANGIER CORPORATION
CORROSION PREVENTIVE AND WATERPROOF PAPERS
FRAMINGHAM, MASSACHUSETTS

Universal Floating Chucks for vertical and for horizontal operation

Left: Universal Floating Chuck Type T for vertical operation. Above: Universal Floating Chuck Type F for horizontal operation.

The unique, rugged design of Universal Floating Collet Chucks speeds up production (F type for horizontal and T type for vertical) of drilling, reaming, and counterboring operations.

The type F for horizontal use in an automatic screw machine or turret lathe, has adjustable spring pressure for tool weight compensation. Thus, the work can be approached at high speed without the danger of marring or causing bell-mouthed conditions.

For vertical operation, as in a drill press, the Universal Floating Collet Chuck Type T is self-centering and permits tension adjustment through the taper shank with an Allen Wrench. It is adaptable for reaming and for counterboring where piloting or following the previously drilled hole is desired.

Both types use ball bearing float. Write for full information on Universal Floating Chucks or any of the other fine Universal products illustrated here.

UNIVERSAL TOOLS THAT WILL INCREASE PRODUCTION AND ACCURACY IN YOUR PLANT

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH, MICHIGAN — Fighter Plane Given by Employees — 20% Employee Bond Deductions

SAVINGS FROM USE OF MOTORIZED HAND TRUCKING	
Old Method—Cost per Productive Standard Hour	$ 0.074
New Method—Cost per Productive Standard Hour	$ 0.04
Saving per Productive Standard Hour	$ 0.034
Saving in Percent	46%
Based on 30,000 Productive Standard Hours in this Plant *monthly*, these above savings represent	$ 1,020.00

LINE MATERIAL COMPANY
ELECTRICAL TRANSMISSION DISTRIBUTION AND STREET LIGHTING EQUIPMENT
GENERAL OFFICES MILWAUKEE-WISCONSIN

South Milwaukee, Wis.
22 December 1944

Ind.Engr.Office

Automatic Transporter Co.,
101 West 87th St.,
Chicago, Illinois

Attn: Mr. J.M.Johnson

Gentlemen:

May we call your attention to an article that appeared in the latest issue of EXIDE TOPICS. On Page 8 of this issue a short resume is given of what we have been able to accomplish at our home plant here at South Milwaukee in cutting down trucking costs and trucking expense.

While this article particularly emphasizes the Exide batteries, an equal amount of credit, if not more, is due to that wonderful little hand truck, the Automatic Transporter.

The 46% saving on trucking expenses shown in this article, are mainly due to the applicability of this hand truck and the efficiency of its performance which caused it to be in great demand by any of our trucking people. We have, today in our plant, six (6) such trucks in operation, when at the beginning it was felt whether or not it would be justified to spend the money for even one unit.

Some of the most important points on the Automatic Transporters are the front wheel drive which provides ample clearance under the chasis to negotiate ramps, of which our plant here has more than its goodly share. The next important point is the low maintenance cost which has as a matter of fact, been so low that we have discontinued keeping a special account for such repairs.

You certainly have a wonderful job and if there is anything we can do to help other manufacturers in the selection of their trucks or in the solving of their trucking problems, we will be glad to co-operate with you or them. As a matter of fact, if you have any chance to use the magazine article for further quotations, as far as the Line Material Company is concerned, you have our permission to use it.

Yours very truly,

LINE MATERIAL COMPANY,
Geo. A. Sievers, Ind.Engr.

CS:oh WHEN YOU ORDER LINE MATERIAL SPECIFY "LINE MATERIAL"

SWITCHOVER to TRANSPORTER PLATFORM LIFT TRUCKS MAKES Savings LIKE THIS

The 6 "Electric Propelled" TRANSPORTERS not only move more tons per trucker than was done by old types of trucking equipment, but require only one operator per TRANSPORTER. The Line Material Company, South Milwaukee, Wisconsin says their TRANSPORTERS maneuver with ease in the narrowest aisles and negotiate the steepest ramps. Materials are moved more quickly and safely between operations—workers and machinery are not held up by slow or delayed deliveries.

Write, phone, or wire for Bulletin No. 8

●

Breakable lightning arresters, assembled hi-tension switch parts, porcelain bodies for cutout devices, brackets, pole line hardware, heavy transformer parts, and considerable material in rough form are handled on skids through a series of manufacturing processes. Picture shows formed and galvanized metal parts being transported through the weighing operations.

- Positive mechanical brake
- Controls in steering handle
- Forward and reverse speeds
- Front wheel power drive
- Shockless hydraulic lift with easy foot control
- "Dead-Man" control

MANUFACTURERS FOR OVER 38 YEARS *Electric Propelled* INDUSTRIAL TRUCKS

ELECTRIC INDUSTRIAL TRUCKS
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AUTOMATIC TRANSPORTATION CO.
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Division of the Yale & Towne Manufacturing Company

LOOKS BEAUTIFUL . .
but show us the *best way* to build it!

U.S. Broach Company's modern building exterior exemplifies up to date precision manufacturing methods within its walls. Write today for picture story of this plant.

WASHING MACHINES, refrigerators, toasters, vacuum cleaners and even steam shovels have taken on that slick streamlined appearance that is the dream of every industrial designer. But, like all ideas on drawing boards, it takes plenty of thinking to make them real.

That is the problem that confronts many manufacturers today—how to build their new products on a *competitive price basis.*

Right here is where U. S. Broach engineers have proved themselves valuable, for in working out production short cuts by designing broaches that will perform several cutting operations with one "pass," they have materially reduced the manufacturers' machinery costs.

No, we don't say all precision cutting problems can be solved by broaching—however, if you have a job that requires considerable time in milling and boring operations, we invite you to write our engineering department today, outlining *your* particular problem.

U.S. BROACH Company

6464 E. SEVEN MILE ROAD — DETROIT 12, MICH.

TELEPHONE TWINBROOK 1-2211

● THE LIMITROL COMPARATOR ROLL THREAD SNAP GAGE by WOODWORTH has proven its *efficiency* and *utility* in hundreds of war plants for many months under the pressure of war production. The LIMITROL has proven that it will reduce effectively your inspection costs by combining greater *speed* with greater *accuracy.*

The LIMITROL *checks* errors involving pitch diameter, lead, taper, angle, out-of-roundness and straightness. Also supplied with rolls to check plain parts. It eliminates "feel" and reduces scrap. *Write for your copy of the Limitrol Catalog No. 44-L.*

ACCURACY YOU W CAN TRUST

WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD · DETROIT 20, MICHIGAN

PRECISION GAGES · PRECISION MACHINED PARTS · PRECISION TOOLS

Just how much can the right cutting fluid save?

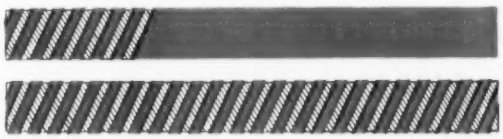
● A "DUAL" PROBLEM faces practically every metal working plant today. First, is the need for keeping the number of cutting fluids stocked to the minimum, and second is the need for using cutting fluids that will give the greatest tool life, accuracy, and production on *each* job.

This problem has not been simplified by the war. A greater variety of metals and materials is being machined. Many will continue to be used after the war. In some plants it may be difficult to return to one cutting fluid that can be used plant-wide.

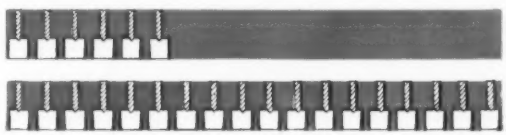
To complicate the problem further, cutting fluids have been developed that do specific jobs unusually well. The cost-saving advantage may make it economical to use more than one oil. The question is, just how much will exactly the right cutting fluid save?

Why not put this "dual" problem up to a Standard Cutting Oil Specialist? He understands your need to keep the number of cutting fluids stocked to the minimum. But he'll know where new developments will make it pay to add, or change to, a cutting oil that's more closely fitted for the job. A few examples of such jobs and savings they have made are briefly outlined here. A Standard Cutting Oil Specialist can cite many more. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Cutting Oil Specialist near you.

Saves three wheel dressings out of four. In a production performance test between two emulsified coolants—one of them Superla Soluble Oil—on a centerless grinder, wheels were dressed every ten hours with Superla, every two and one-half hours with the other oil. This meant a saving in machine time, wheels, and labor that easily proved the value of getting exactly the right oil.



24 four-foot threads in place of 7 per chaser. The job was cutting a continuous thread, four feet long on three quarter-inch, hot rolled SAE 4130 stock. With the cutting oil in use it was practically impossible to get a completely perfect, full-length thread. Seven parts per chaser was the limit because the die overheated and became loaded. When a test of Stanicut 309 BCS was made, overheating was eliminated, and parts produced jumped to 24 per chaser—or 96 feet of perfect threads. This is a typical saving where Stanicut 309BCS—a war-developed cutting oil—is applied to threading, broaching, or heavy turning operations.



Jumps from six to eighteen pieces per drill-grind. A heavy-duty soluble oil—Stanicool HD—is designed for those in-between jobs where the rapid cooling quality of a soluble oil is needed, plus the tool-protecting quality of cutting oil. One such job was drilling a ¼ inch hole, four inches deep, in a SAE 1040 steel casting. Cutting oil did not cool the work and tools sufficiently because of the depth of the drilled hole. Tool life was poor with conventional soluble oils in a wide range of emulsion concentrations. Drills were ground every six pieces. An emulsion of one part Stanicool to eight parts of water increased production to 18 pieces per grind, and cooling was adequate.

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For easier handling in grease guns... longer life in anti-friction bearings

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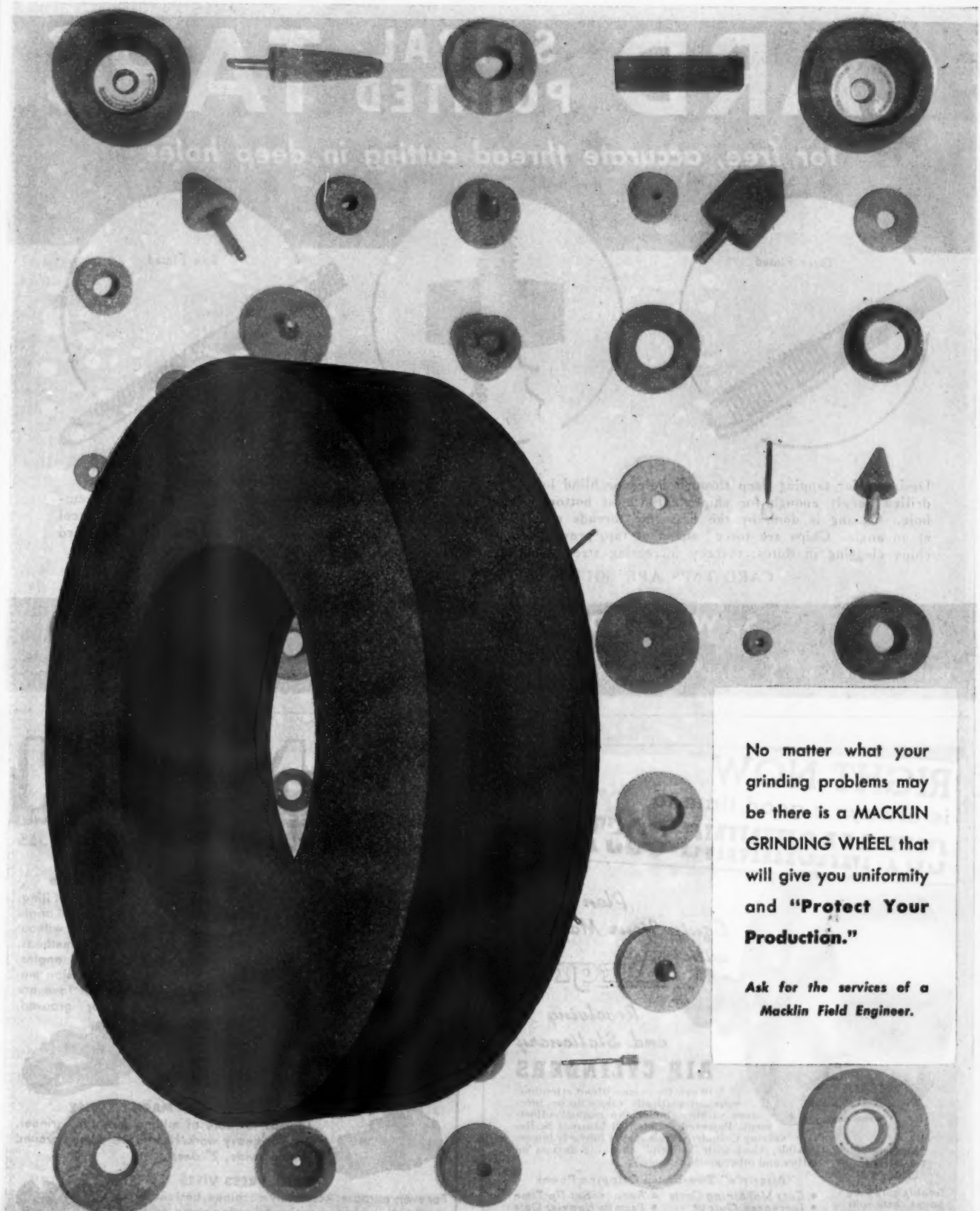

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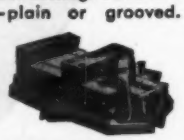

For fast, heavy work. Adjustable cam locking lever. Movable jaws, hardened and ground. Sizes 3" to 8" Jaws.

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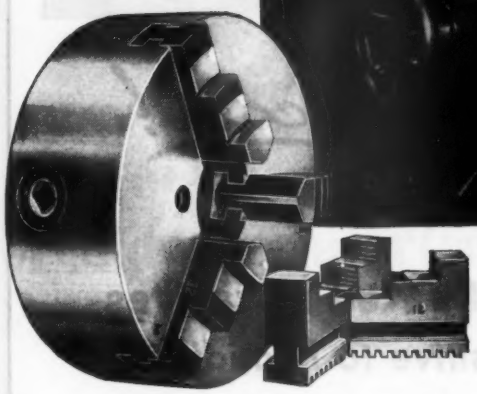

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These Cushman Chucks are typical of the top-quality, up-to-the-minute equipment you'll find in every department of Pan American World Airways huge maintenance shops. Maintenance aces who keep the Clippers flying are doing a most vital war-time job . . . insist upon the very best in machinery and tools. We're proud to know Cushman Chucks are doing their part in this great organization. And we call it to your attention simply because it again emphasizes the importance of chucks in almost every phase of war production. If you "Choose 'em right, use 'em right and treat 'em right" you will increase output per chuck and lengthen service life. Let us send you a supply of our "Chuck Check" maintenance cards . . . one for each lathe in your shop. The Cushman Chuck Company, Hartford 1, Conn.

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Send for these "Chuck Check" maintenance cards today.

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QUALITY ABRASIVES

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BETTER METAL SANDING

no added cost!

Longer, Cooler Cutting Life from Coated Abrasives

More resistant to heat . . . Less sensitive to humidity

Now you'll get substantially increased cutting life from your high speed belts, discs and coated abrasive specialties—by using Behr-Manning Metalite Cloth Durabonded.

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MIDWEST HY-PRESSURE LOCK INSERTED BLADE CUTTER BULLETIN 1144

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Mogul	Molybdenum
Mustang	6-6-2 Type
Mustang Special	6-6-2 + 5% Cobalt

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Top Notch	Shock-Resisting
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CNS	Air Hardening
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YOU'LL WANT TO KNOW

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- improve tool performance and cut costs
- save time and money in the toolroom
- the relation of design to heat treatment
- trouble shooting
- testing procedures

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By FRANK R. PALMER
Vice-President of
The Carpenter Steel Company

315 *Pages* 205 *Illustrations*
$1.00 *Postpaid in U. S. A.* *Elsewhere* $3.50

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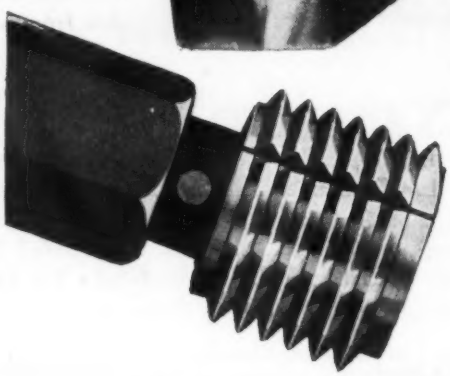

It's found in a fighting champ—
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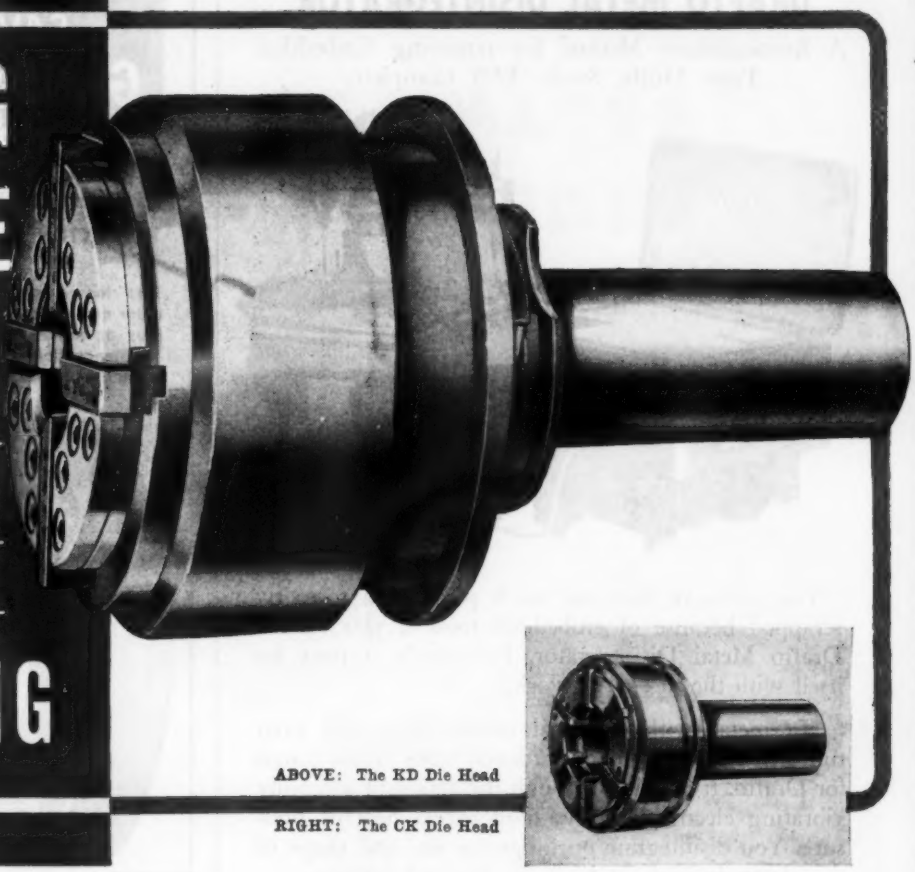

ABOVE: The KD Die Head

RIGHT: The CK Die Head

....yours in this GEOMETRIC STYLE KD ROTARY SELF-OPENING DIE HEAD!

STYLE KD

Made for use on any live spindle machine, the Style KD Rotary Die Head is a tool that meets today's demand for speed and foreshadows long, profitable performance on post-war competitive production.

QUICK FACTS: The KD is a compact tool that swings in small space, thanks to nested construction. Trips positively with a snap, and every time at exactly the same point. This is a spool trip die head, opened and closed by a yoke fitting in spool section of trip flange. Head has no chance to miss catch and ruin work or machine. Unique Geometric construction facilitates close-to-shoulder threading — no solid face plate to remove, no projection chasers to buy. Simple design makes it easy to operate and keep in repair. Easy chaser removal —no tools necessary, no screws to loosen, just slip chasers out by hand without removing tool from machine. Face plates are segmental and removable, may be trued up in case of wear and screwed back into place.

Try out one of these tools — you'll be surprised at your low threading cost, pleased at the ease with which you get smooth, accurate threads! Made in six sizes, with a cutting range for straight threads from 1/16" up to 2" for the duration (otherwise up to 5").

STYLE CK

If your threading job requires fine pitch threads on larger diameter work, and your machine won't accommodate a heavy-duty tool like the KD because there is not enough room for it to swing on the machine, or the tool is too heavy for machine or work—choose the Geometric CK Rotary Die Head (small tool, above). Similar in design to the KD, the CK Die Head is smaller in diameter, uses smaller, lighter chasers. Five sizes, capacity 7/16" to 3¼".

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NEW HAVEN 15, CONNECTICUT

DRAFTO METAL DISINTEGRATOR

A Revolutionary Method for removing Embedded Taps, Drills, Studs. $295 Complete.

You can save dies and work pieces you formerly scrapped because of embedded tools if you have a Drafto Metal Disintegrator. Frequently it pays for itself with the first day's work.

No metal with electrical conductivity, not even tungsten-carbide or case hardened steel, is too tough for Drafto. It operates through the action of a rapidly vibrating electrical arc, without excess heat or pressure. You disintegrate openings the size and shape of the electrode without harming finished surfaces.

The "Head" (sketched below) is chucked solidly in a drill press, lathe, or other holding device, and the work piece is clamped firmly to avoid movement. Disintegration takes place only where the electrode comes in contact with the metal to be worked on.

Drafto Metal Disintegrator is used to remove broken taps, drills, studs, and pins; and to form openings in hardened steel. Other uses are being developed daily.

It is made for 110v. or 220v. 60 cycle power. Be sure to specify which you use.

Drafto Metal Disintegrator requires no lengthy training period. Anyone can use it. It comes to you complete, ready to go to work for $295. Manufactured by Drafto Corporation, Cochranton, Penn'a. Representatives in key cities. Write, wire or phone for bulletins and details.

Representatives in key cities.

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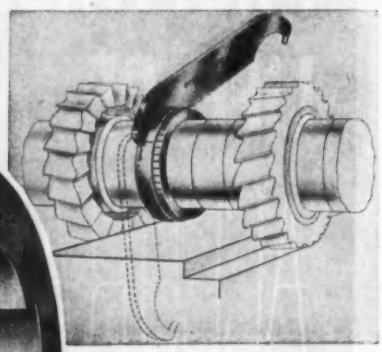
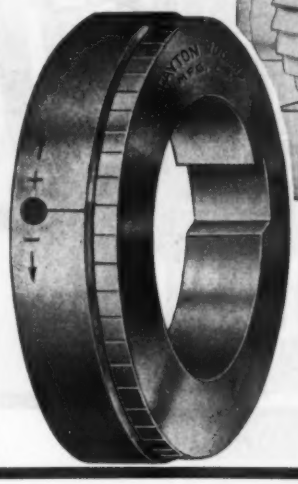
SAVE TIME ON YOUR GANG MILLING SET-UPS

You are assured FAST—ACCURATE spacing on all side milling cutters and gang milling setups with

DAYTON ROGERS ADJUSTABLE SPACING COLLARS

Just loosen cutter arbor nut and make plus or minus adjustment with handy wrench as shown.





"DAYTON ROGERS" ADJUSTABLE SPACING COLLARS are graduated in thousandths, with plus or minus markings as illustrated. A .0005 adjustment can easily be made by visual calibration. These collars are made in 12 standard sizes from ⅜" to 2".

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All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles

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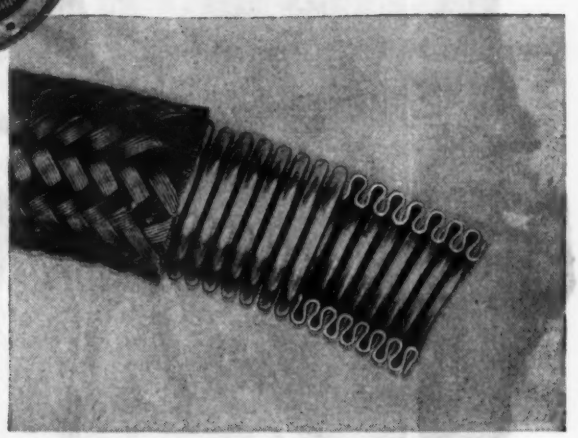
AMERICAN SEAMLESS COOLS X-RAY TUBES



Note how American Seamless Flexible Metal Tubing is formed from a seamless, rustless, bronze tube. In most applications one or more bronze wire braidings are added, depending on the service for which it is designed.

ENGINEERS of the Machlett Laboratories, at Springdale, Conn., world's largest manufacturers of X-ray tubes, have found in American Seamless Flexible Metal Tubing, the solution to the problem of compact, efficient cooling for X-ray tubes.

A length of bronze American Seamless, without the customary wire braiding, is coiled around the inner surface of the cooling jacket and connected to a water inlet and outlet. The Roentgen tube is then inserted in the jacket and the ends sealed.

In operation, the tube is surrounded with oil which absorbs the heat from the tube. Cooling water, flowing through the American Seamless coil, removes the heat from the oil. As will be seen in the illustration, the flexibility of this tubing permits it to conform perfectly to the chamber wall. Its seamless construction eliminates leakage problems, while its thin-wall, bellows-like construction assures high efficiency in heat transfer, the bellows rings having the effect of cooling fins.

If you have a problem in conveying liquids, gases, steam or solids . . . isolating vibration . . . connecting moving parts or compensating for misalignment, you will be interested in the wide variety of "American" Products for these purposes. Send for a copy of Bulletin No. SS-50.

ANACONDA *American Metal Hose*

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY • General Offices: Waterbury 88, Conn.
Subsidiary of Anaconda Copper Mining Company • *In Canada:* ANACONDA AMERICAN BRASS LTD., *New Toronto, Ontario*

BUY WAR BONDS—Saved Dollars mean Saved Lives

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DON'T LET RUST RUN WILD IN YOUR PLANT

LIKE SOME TERRIBLE PLAGUE, rust spreads its ruin everywhere.

Annually this thieving demon costs American Industry more than a billion dollars!

Until recently, rust has been accepted as a necessary evil in many operations.

Today, thanks to new developments, various types of rust-preventive coatings and lubricating oils are obtainable.

SHELL ENSIS RUST-PREVENTIVE COATINGS

As protection against rain and snow during outdoor storage, or high humidity conditions *inside*, Shell offers a complete line of Shell Ensis Rust Preventives. These oils, fluids, and compounds come in various grades, each designed to meet a specific condition. Protective coatings range from thin transparent coverings that need not be removed, to coatings that resist extremes of weather over long periods.

SHELL TELLUS RUST-PREVENTIVE LUBRICATING OILS

Where moisture is a factor, Shell Tellus Oils are recommended for machine lubrication. These scientifically developed oils cannot remove rust once it has started. However, because of special, built-in, rust inhibitors, they afford protection against the formation of rust—this without loss of lubrication qualities.

Call in the Shell man. He is a trained man, competent to study your operation and advise you. Let him show you how to keep rust out of your plant. Write, wire or phone —Shell Oil Company Inc., 50 West 50th Street, New York 20, N. Y., or 100 Bush Street, San Francisco 6, Calif.

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OUT OUR WAY
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GIT A LOAD OF THE OLD BULL TRYING TO BY-PASS THE FLORADORA LINE
THE LAST TIME HE PRAISED ONE OF DEM ROCKETTES THE REST OF 'EM POUTED FOR A WEEK
J R WILLIAMS
THE INDOOR GENERAL

The Old Bull Keeps The Pressure Up

There are all kinds of news headlines these days but there's only one that will make the Old Bull take the pressure off. That's the announcement of final Victory. Until then, there's still a lot of work to be done and he and thousands like him are not the kind to rest on their oars.

And there's a peacetime world to prepare for, too—where the lessons of wartime precision on a low-cost, mass-production basis means better and finer things for new millions of Americans.

(Below) Some of the many thousands of our precision parts that help "Keep 'em flying and fighting." Let's all back the attack—Buy EXTRA War Bonds.

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For 10" ATLAS & LOGAN, SOUTH BEND, SHELDON, CRAFTSMAN, POWR-KRAFT, CLAUSING and other important lathes.

IMMEDIATE DELIVERY FROM STOCK

The *Precision* name on a collet is your unconditional guarantee of accuracy in machining, hardening and grinding. Make sure then to specify *Precision* when ordering from your dealer. Literature on request.

- MODEL 3AT. For 10" Atlas, Logan, 12" Craftsman, No. 700 Powr-Kraft.
- MODEL 3C: For 8" & 9" South Bend, Clausing, Hardinge No. 3, 10" LeBlond, etc.
- MODEL 1A: For 8" & 9" South Bend.
- MODEL 5C: For 9", 10", 16", 18" South Bend, 1" capacity Sheldon, Schauer, Sebastian, etc.
- MODEL 4C: For 14½" South Bend, ¾" capacity Sheldon, Hardinge No. 4, Elgin, etc.
- MODEL 480: For Logan Screw Machine, Turret Lathe and attachments; Warner & Swasey No. 1, etc.
- BREN Collet: For Handwheel & Lever-Type Speedichuk.

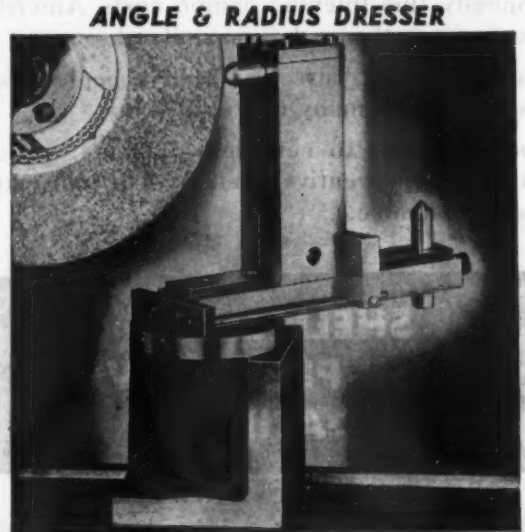
KLUTCH - KOLLET (Step Chuck) for checking work to 2¾" diameter with collet accuracy. Head unhardened for easy boring. Fits 3AT, 3C, 1A adapters only. List unbored $7.50 each.

- 5C KLUTCH-KOLLET NOW READY. List unbored $10.50
- PRECISION Collets also available in Hex. and Square.

GENERAL DIE-STAMPING-TOOL COMPANY • 252 Mott St., New York 12, N. Y.

The "FORM MASTER"

ANGLE & RADIUS DRESSER



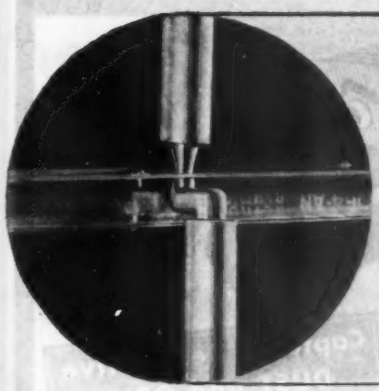
A sturdy, quality instrument designed by form-grinding specialists to dress BOTH angles and radius at low cost. Two 1/3 ct. diamonds and case included—$150.00 complete.

Features

Large range	.0001" accuracy obtainable
Chatterless	Simple to operate
Dustproof	Reasonably priced

Call your supplier or write

J. & S. TOOL CO. 477 Main Street E. ORANGE 1, N. J.



DO'S *and* DON'TS
for
Resistance Welding Machines and Operations

Do's

1. Clean and tighten all electrical connections in the secondary circuit regularly.
2. Protect welding transformer slides, bearings and other parts from flash particles.
3. Keep the welder throat area to the minimum permissible dimensions.
4. Design welding fixtures and clamps with non-magnetic materials whenever possible.
5. Lubricate the resistance welding machine, motor, gears and slides at periodic intervals.
6. Clean all air or oil filters regularly.
7. Keep leather cup washers in air cylinders soft and pliable with light motor oil.
8. Calibrate all pressure applying mechanisms so that the exact welding pressure is always known.
9. Use proper capacity welding machine for the job.
10. Adjust the welding machine properly with the current initiating devices so that the current cycle is spaced midway in the pressure cycle.
11. Clean either chemically or mechanically all material to be welded that has dirty, scaly, oxidized or otherwise contaminated surfaces.
12. Provide suitable fixtures for holding the work in position prior to applying electrodes.
13. Provide rigidity in the welder arms and holders to prevent skidding of the electrodes, wheels or dies under pressure.

Don'ts

1. Don't permit flash particles to accumulate on the welding transformer.
2. Never use poorly maintained resistance welding equipment.
3. Do not use a long welder arm extension or a wide arm separation unless the parts to be welded necessitate it.
4. Avoid placing or fastening steel parts or fixtures in the throat area of the welding machine.
5. Shun lubricants which are not recommended by the welder manufacturer.
6. Don't use air operated machines when the oil bowl in the air line is empty.
7. Never permit oil or grease to come in contact with the transformer winding, electrical wires, or connections.
8. Never permit sliding pressure members to become too tight or jammed, since this will increase the frictional forces and inertia of the moving members.
9. Avoid using a low capacity welder for heavy welding jobs.
10. Do not allow welding current to be applied before full pressure is on work, or permit pressure release before the welding current is cut off.
11. Never weld unclean metals, scaly stock, or metals with poor surface condition.
12. Don't use welding tips, wheels or dies to form or shape parts in the welder.
13. Never apply the electrodes to the work with a hard impact or hammer blow.

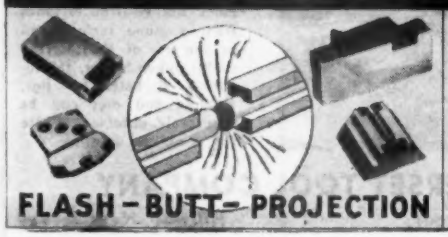
DO increase production by using Mallory Standard Resistance Welding Electrodes —spot welding tips and holders. Consult us for seam welding wheels, flash, butt and projection welding dies for your particular application. Write for your copy of the electrode catalog and the Mallory Resistance Welding Data Book sent gratis to resistance welding engineers when requested on company letterhead.

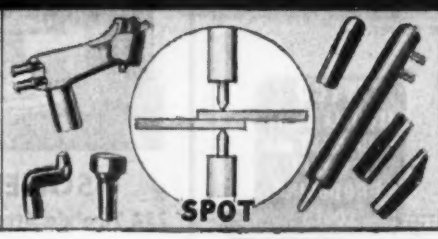
One of a series—the entire series mailed at your request.

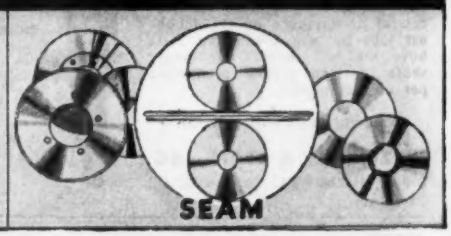
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

P. R. MALLORY & CO. Inc

MALLORY *Standard Resistance Welding Electrodes*







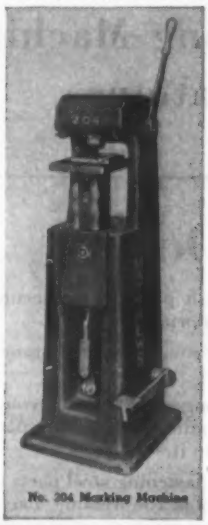
MARKING MACHINES

STEEL DIES—TYPE AND FIXTURES

Matthews marking machines, dies, type and fixtures supplied for marking names, codes, trade names, trade marks, patent numbers, etc., on all types of industrial parts or products.

Write for your copy of Catalog 1468

Flat Die for Marking Round Parts



No. 204 Marking Machine

Round Die for Marking Flat Parts

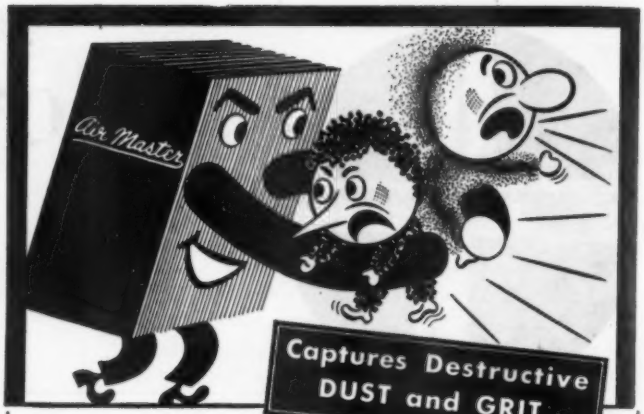
Roller Die with Interchangeable Type

JAS. H. MATTHEWS & CO.

3956 FORBES STREET PITTSBURGH 13, PA.

Branch Plants

New York, Boston, Chicago, Philadelphia, Newark, Syracuse
District Sales Offices: Cleveland, Hartford, Birmingham



Captures Destructive DUST and GRIT

The AIR-MASTER is sure protection against the destructive dust and grit thrown off by grinders and buffers. It sucks them up right at the moment they fly off the wheels. Your employees are freed from the dangers of inhaling these destroyers of health—and the sensitive parts of your fine machinery are protected against their gritty, abrasive action.

The AIR-MASTER is fully self-contained—efficient, rugged, dependable. A size for every grinder and buffer.

Master dust and grit, Install the AIR-MASTER

Write for full details

NOW AVAILABLE. Two, Three and Five H.P. grinders on AA-5 priority or better.

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ELECTRIC DRILLS • GRINDERS • BUFFERS • PORTABLE TOOLS

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DIVISION OF THE R. K. LEBLOND MACHINE TOOL CO. CINCINNATI, OHIO

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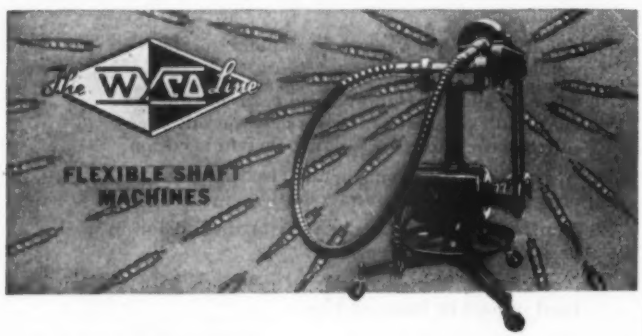

YOU ARE SURE of the Best When You Select from the WYCO CATALOG

There is a right machine for every job—WYCO Flexible Shaft Equipment includes a complete range of machines to meet every production requirement . . . with mountings to suit every working condition.

WYCO Flexible Shaft Machines have won national recognition for successful performance on the toughest jobs for war production . . . have set *new records* for longer shaft life and greater production per unit of power!

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WYZENBEEK & STAFF, INC.
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MODEL 53-A

Selective Speeds 1800, 3600 or 6000 RPM. 1½ HP 3-phase motor and 7 ft. Shaft. Note low center of gravity—no danger of tipping over.

Only WYCO Flexible Shafts have this Patented Non-Metallic Innerliner — Makes the Core last longer . . . Run smoother . . . Transmit more power.

WYCO
FLEXIBLE SHAFT EQUIPMENT and PROFIT PRODUCING TOOLS

Famous for

- ACCURACY OF THREADS
- LOW CHASER COST
- ALL AROUND DEPENDABILITY

Bulletins available: General Purpose Die Heads, Insert Chaser Die Head, Threading Machines.

See our Advt. on page 238 Jan. 18, '45, American Machinist

THE EASTERN MACHINE SCREW CORP., 20-40 Barclay St., New Haven, Conn.
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HELICAL TAPER PIN REAMERS

Scientifically made of selected steel under modern processes. Long lived, economical, accurate. Details on request.

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SOMERSET LAYOUT
complete set $16.00

This attachment quickly converts your height gage, planer gage or gage blocks into a tool that can be compared to a jig borer. With it you can layout work easily and accurately. Designed to mark off vertical distance from a plane surface and by the use of the inserted center punch holder, the locating of holes for jigs, fixtures and dies can be accurately obtained. Write for complete details.

SOMERSET TOOL COMPANY
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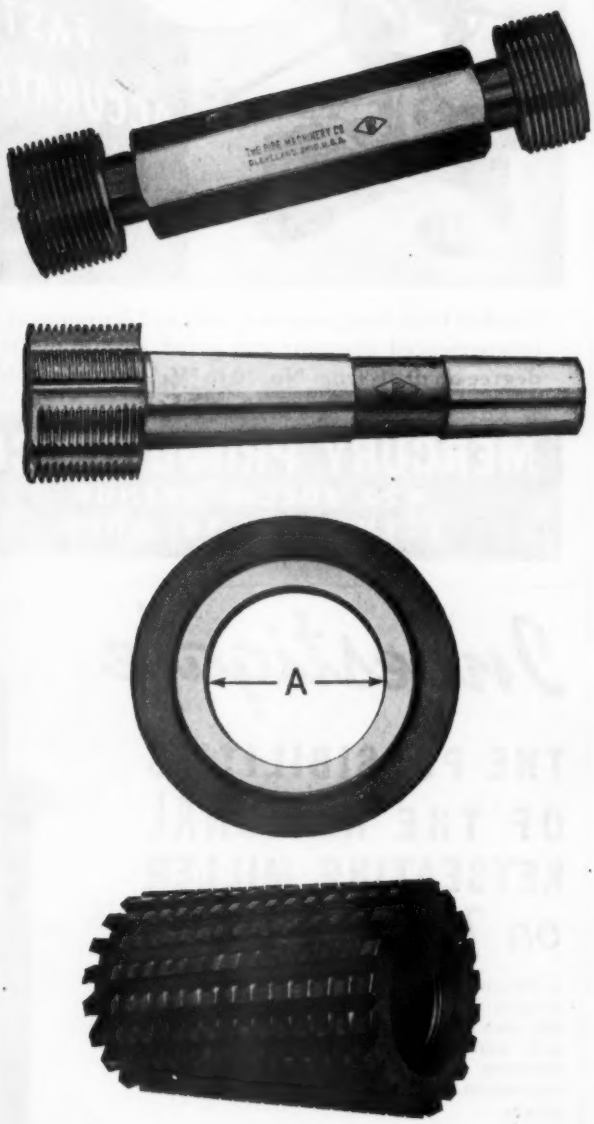
The modern importance of TENTHS



Modern mass production is largely the science of making things fit . . . not approximately, but precisely.

Because of this accurate fit of parts, we have better performance, longer life, in all of our machinery.

32 years of experience . . . of qualifying as THREAD SPECIALISTS . . . has made the men who engineer and build Pipe Machinery threading tools and gages completely familiar with modern standards of precision. They know how to maintain these standards on the production line.

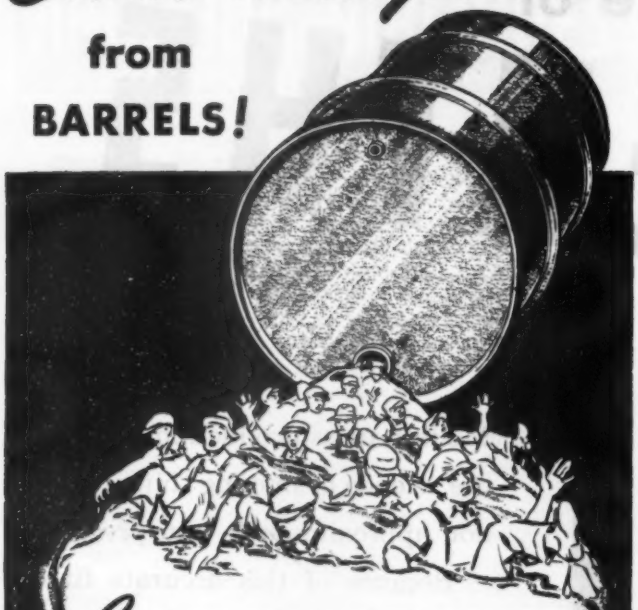
The PM trade-mark on tools and gages gives you something to tie to . . . a sure guide to sustained accuracy.

Consult your PM Handbook, or write us about special requirements.

PM CO

The PIPE MACHINERY COMPANY Cleveland, O.

Extra Manpower from BARRELS!



CORRECT APPLICATION of correct cutting fluids reduces rejects, improves finish, prolongs tool life, lessens down time . . . with the result that machinists have less trouble, get more done, better and quicker.

Adding productive man-hours by working with cutting fluids is an every day occurrence with Stuart men. They are backed by a complete line of laboratory controlled cutting fluids made by a company of eighty years experience. They know how to evaluate properly all the factors which affect the selection of a cutting fluid.

Call for the FREE services of a Stuart man. Let him help you to attack your manpower problem from a new angle.

The Stuart 60-page booklet, "Cutting Fluids for Better Machining," is full of specific data, well illustrated. Write for your free copy.

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JUST 20 SECONDS
FOR SMALL DRILLS FROM No. 70 TO 15/64"

Tombill Drill Sharpener is speedy and economical. An inexperienced operator can grind exactly the right degree on drills from No. 70 to 15/64". Write for folder.

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Investigate

THE POSSIBILITIES OF THE NATIONAL KEYSEATING MILLER on Your Work

• Shops all over the country are solving difficult keyseating problems by chucking this attachment on their drill presses, radials and horizontal boring mills—and milling keyseats in pieces too large or bulky for convenient handling on keyseating machines.

The "National" goes through the hole once and mills keyseats with parallel sides and parallel with the axis of the bore. It's a big time and money saver and is available in standard stock diameters from ½" to 3½" for cutting lengths from 1⅞" to 12". It will keyseat in blind holes, taper holes, and offset holes. We also manufacture oil-grooving millers.

Several widths of cutters can be used with each size miller and many different hole diameters keyseated with one tool through the use of eccentric bushings.

WRITE today for Catalog No. 15

NATIONAL MACHINE TOOL CO.
CINCINNATI, OHIO

Smooth Sharp Edges

FOR CEMENTED CARBIDE TOOLS

Bay State provides top grinding performance for your cemented carbide tools because

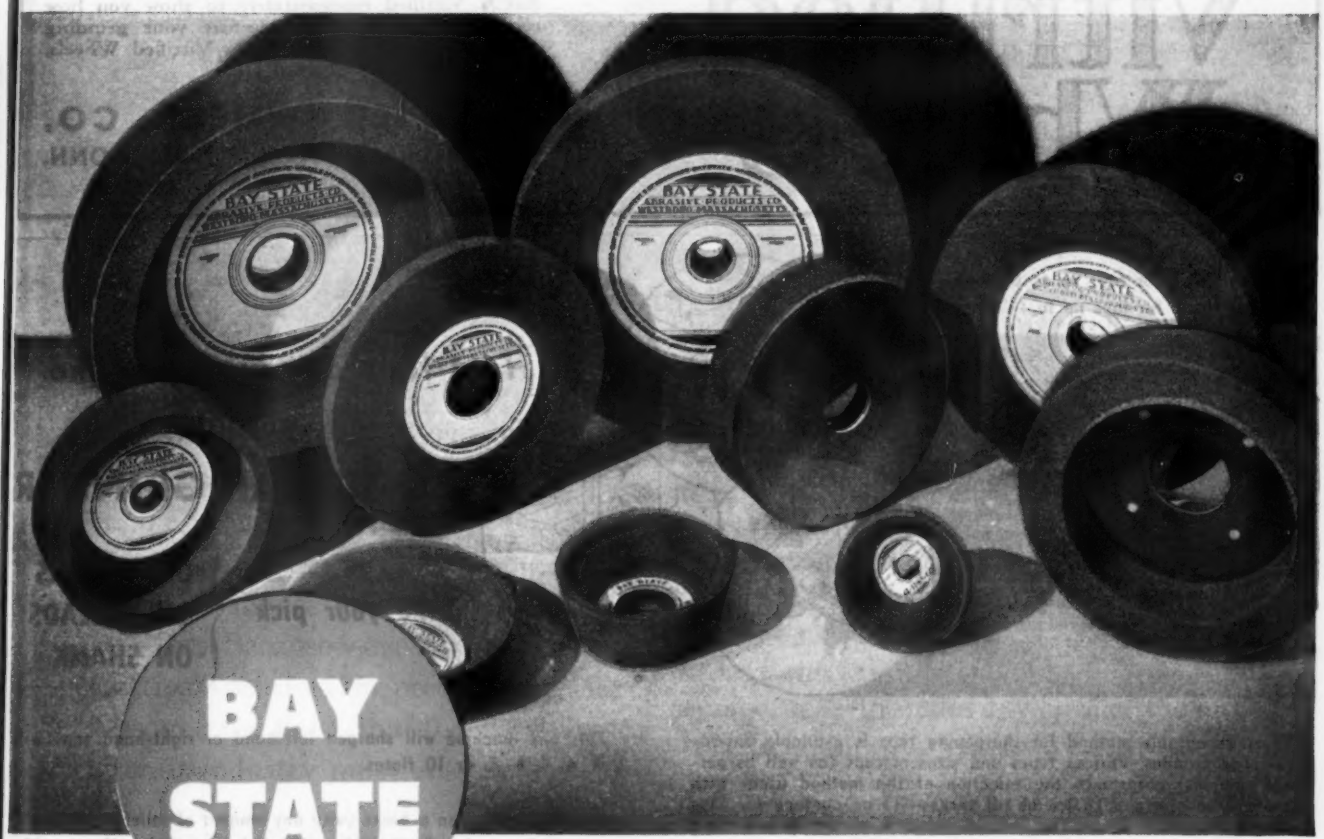
1. Fractional Grades—
   3 grades within a grade, more accurately "fitting grade to grind."
2. Controlled Porosity—
   scientific control of wheel structure.
3. Consistent Duplication.

For grinding cemented carbide tools, you want sharpening wheels that are cool and fast-cutting, produce keen edges and have long life. Bay State's Green Grit Wheels meet these requirements fully.

KOOLPORE, Bay State's very open and porous Green Grit Wheel, is highly recommended by users for rapid grinding of the cemented carbides.

Make a trial of Bay State Green Grit regular structure and Koolpore types. For any grinding wheel need, remember Bay State's exclusive methods of duplicating original specifications. Write for recommendations for your needs or contact the Bay State distributor, warehouse, or field engineer in your area.

BAY STATE ABRASIVE PRODUCTS CO.
1 Union Street, Westboro, Mass.



BAY STATE

ABRASIVE PRODUCTS

Top Performance Consistently Duplicated

GRINDING WHEELS · HONING AND SUPERFINISHING STONES · PORTABLE SNAGGING WHEELS
MOUNTED WHEELS AND POINTS · CUT-OFF WHEELS · INSERTED-NUT DISCS AND CYLINDERS

VITRIFIED

Keep production on its toes by standardizing on . . .
VITRIFIED GRINDING WHEELS

The Vitrified complete line includes also Silicate, Shellac and Resinoid bonded wheels for conditions requiring high finish, elasticity and heat resistance.

Grinding equipment—for tools or for production requirements—can be brought to higher degrees of precision and speed by standardization of Grinding Wheels.

These objectives can easily be realized through the use of Vitrified Wheels for every grinding operation, because Vitrified offers a complete line of sizes, shapes and types, processed especially for the work to be handled.

. . . Cast Iron, Bronze, etc., can be ground at low cost and efficiency on Vitrified Carborite Wheels. . . . For accurate, fast grinding of steel on a production basis, Vitrified Borite Grinding Wheels increase output and reduce costs.

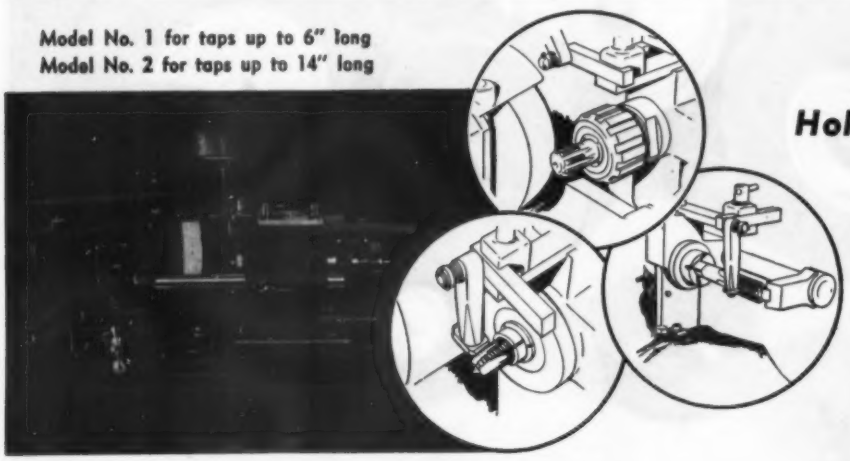
. . . Also, make Silicate, Shellac and Resinoid Bonded Wheels.

Ask a Vitrified representative to show you how economically you can modernize your grinding operations by standardizing on Vitrified Wheels.

Vitrified Wheels

VITRIFIED WHEEL CO.
WESTFIELD CONN.

Model No. 1 for taps up to 6" long
Model No. 2 for taps up to 14" long



Hold taps any way you like on any

BLAKE TAP GRINDER

Take your pick { **ON CENTERS** / **ON THREADS** / **ON SHANK**

Every acceptable method for sharpening taps is available on any Blake Tap Grinder. Various types and sizes of taps (as well as personal opinions) enter into the selection of the method used—with the Blake you have a choice of all three—(1) on centers, for taps from No. 0 to 2"; (2) on the outside diameter of the thread, from No. 0 to ½"; (3) on the shank from No. 0 to ⅝".

This one machine will sharpen left-hand or right-hand taps with 2, 3, 4, 5, 6, 8, or 10 flutes.

Keep taps sharp on a Blake (with any amount of relief desired) and you add thousands of extra threaded holes to their effective life.

No machine is better than the cutting edge of the tool it uses.

EDWARD BLAKE COMPANY

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BLAKE TAP GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS—AMERICAN TOOL HOLDERS—BLACK DIAMOND PRECISION DRILL GRINDERS—WALTHAM CUTTER SHARPENERS

Please send me Bulletin No. 544 which describes the Blake Tap Grinder in detail.
A.M.

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Company.....
Street.....
City..... State.....

Since its formation in 1936, Staples has made tools primarily for the aircraft-engine manufacturer. It is conservative to say that many of the reaming jobs on the B-29 engines were done with Staples Reamers. Because—even in 1936—Staples Cutting Tools had the precision, the hardness, and the finish that tools used by the aircraft industry must possess. Now our greatly expanded facilities permit us to serve not only the aircraft industry but all metal-working plants in which full accuracy is appreciated.

Staples standard line of reamers, end mills, shell end mills and other circular carboloy tipped cutting tools are available from stock. But circumstances *do* change cases, and we are always happy—and competent—to make any special tools to specification upon request.

Staples Tool & Engineering Company
Cincinnati 25 . . . . . Ohio

Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS

REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES • END MILLS • SHELL END MILLS • ALSO A COMPLETE LINE OF CIRCULAR SPECIAL TOOLS

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Available in Types and Mountings for all Grinders and Grinding Wheels

The scope of Gilmore service is complete—from very sharp needle-point diamond tools for use on fine wheels for grinding taps, threads and small contours to large "octahedrons" for truing big wheels to close precision. Gilmore mountings are available for hand and machine dressing of plain as well as specially formed grinding wheels. Gilmore also maintains a fast resetting service, handled by experts which enables users of diamond tools to get maximum service life from their diamonds. Gilmore has long experience in cutting diamonds to your specifications.

Gilmore complete service is made possible through the facilities of a complete plant equipped with every modern method for handling the highly specialized work involved in tool making and cutting of diamonds. From diamond selection by experts to final inspection, all Gilmore Diamond Tools are entrusted to men capable by experience to bring them to the highest degree of completed perfection.

Write for folder showing the various types of Gilmore Diamond Tools available.

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FASTER HAND OR PRESS STAMPING

12 characters, more or less, stamped at one blow. Press the thumb clip and quickly change type or dies for next markings. No weakening groove in type. Heavy Duty Type with "Extra Strength Shoulder" stamps any untempered steel, or other material. Ask for HERCULES HOLDER & TYPE.

Write for literature and price lists.

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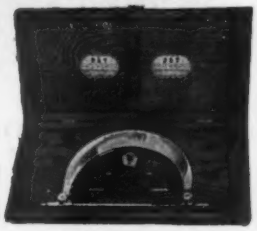
D&T MICROMETERS AND SNAP GAGES

Tubular welded frames with forged ends insure a maximum of accuracy with a minimum of weight.

There are a variety of types available with either micrometer heads or dial indicators to cover a range of capacities from 0 to 168 in. . . *Write for Bulletin 200* or outline your gaging problems.



• D & T Bow Micrometer 0 to 6 in. capacity

Davis and Thompson Co.
Mfrs. of Machine Tools and Micrometers
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BUSHINGS

STANDARD SIZES AVAILABLE FROM STOCK!

Made in A.S.A. Standard in HEADLESS PRESS FIT, HEAD PRESS FIT, FIXED RENEWABLE, HEADLESS LINERS and SLIP RENEWABLE types—also a complete line of Accessories.

Manufactured to precision tolerances from fine grade of tool steel carefully heat treated.

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THREADED PLUG GAGES WITH LEAD CHECKED...

to .00001

VARD threaded plug gages are accurate. Each gage is carefully ground from special gage steel. Gage threads are all hand lapped and polished, after which each gage is minutely checked for diameter, thread form and lead on some of the world's most accurate visual and mechanical testing machines. One of these, the Pratt and Whitney lead tester, checks the lead to an accuracy of .00001-in.

ARMY E NAVY

VARD INC.

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BARKER
WRENCHLESS CHUCKS

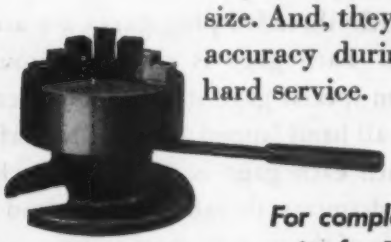
PRODUCE MORE AT LOWER COST!

Barker Wrenchless Chucks are made in two-jaw and three-jaw types; and as vises for milling machines, drill presses, and similar purposes.

Production goes up—and stays up—when Barker Wrenchless Chucks go on the job. These chucks are simple, rugged, self-contained units, that require no accessories, or outside source of power.

They are easy to install, and from the moment they are put in use they will deliver speedy, trouble-free service that pays liberal dividends—greater number of parts per hour, and lower cost per unit.

Precision built, they will hold to a tolerance of 1/1000" either way on round stock of uniform size. And, they will maintain such accuracy during many years of hard service.



For complete information write for Bulletin No. 201.

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Chuck Division
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1905 **Strand** 1945

FLEXIBLE SHAFT MACHINES

VERTICAL AND HORIZONTAL TYPES
⅛ to 3 H.P.

Swivel Yoke Types
¼ to 1½ H.P.

ONE HUNDRED TWENTY-FIVE TYPES and SIZES

Small Bench Types
⅛ to ¼ H.P.

HIGHEST QUALITY MACHINES
HIGH SPEED STEEL ROTARY FILES . . . ROTARY CUTTERS

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Largest Flexible Shaft Line in the World

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CARBIDE TIPPED
Consistent Quality
GAGES AND TOOLS

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Grobet
ROTARY FILES
HAND CUT • MILLED CUT
GROUND FROM THE SOLID

There is a Grobet Rotary File, Cutter, Diesinkers Bur in shape, size, and coarseness of cut for every type of hard or soft metal, plastic, wood, etc. Send for Catalog DR. illustrating the complete line in full size, speed charts, etc.

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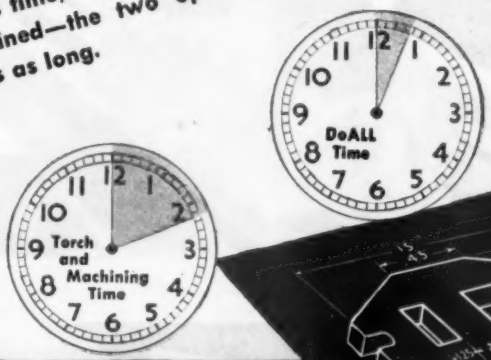
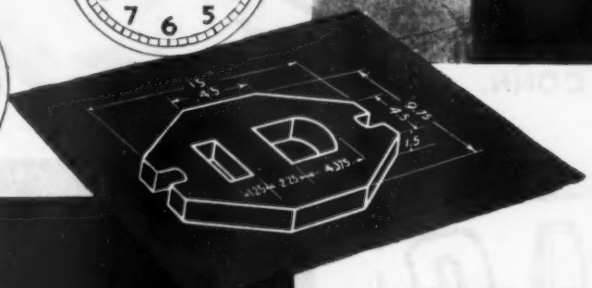
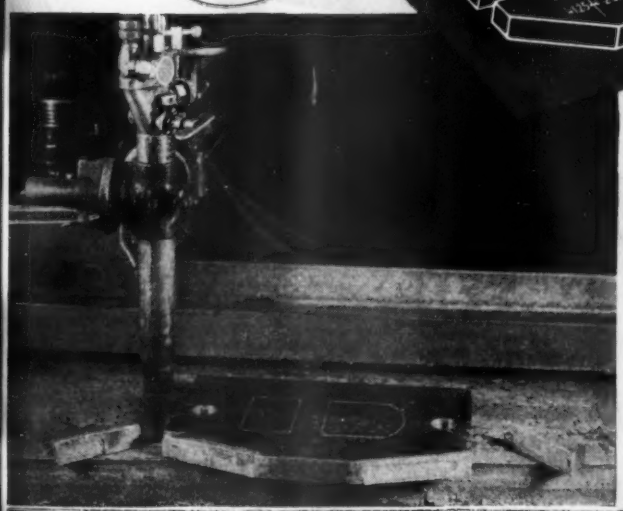
Forty-five minutes to cut this shoe from boiler plate—one easy operation and a square, clean finish.

An acetylene oxygen gas torch cut the shoe in less time, but the burnt edges then had to be machined—the two operations requiring three times as long.







For rough shapes from mild steel, the torch offers a fast cutting method, but for machine finish precision work, use the DoALL.

Another thing, the torch will not cut non-ferrous metals, aluminum, brass, cast iron, bakelite, fibre products—the DoALL will. The torch is impracticable for tool steel shapes, which the DoALL handles easily.

Yes, DoALL cuts them all—today's most modern and rapid machining method. Does both internal and external cutting, following straight or contour lines accurately and without metal waste.

DoALL Advantages over 10 Basic Cutting Methods are shown in pictures in a new booklet. Write for copy today.

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Simple in design, practical, convenient, and accurate the Hartford V-Block Fixture is a valuable device for speeding production on a wide range of irregular work.

Shown here is one of its many applications. In this case, the V-Block Fixture is mounted lengthwise on a milling machine table for boring at right angles to previously bored holes. Should facing operations be required while in this position, they could easily be handled without changing the set-up of the work.

The Hartford V-Block Fixture consists of accurately machined, ground and hardened steel V-blocks mounted, with facilities for adjustment on a cast iron base. The base is accurately machined and scraped and provided with ample clamping facilities. Holding means are provided for the work.

With the "Hartford", set-ups for boring, milling, reaming and inspection operations can be greatly speeded up. It will be to your advantage to investigate *now*.

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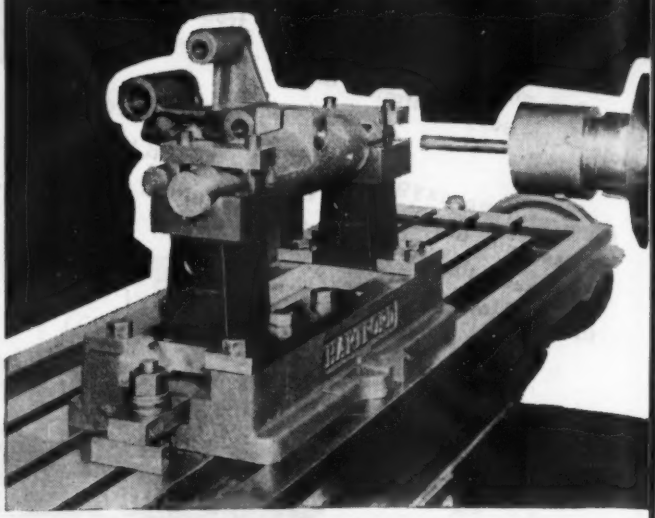

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• Noblewest High-Speed Precision Marking Machines are designed to mark your products, regardless of shape or size, faster, better, at lower cost. With the famed Noblewest rolling process, production speeds for marking, knurling or graduating, are practically unlimited. Write for wartime catalog supplement No. 43.

MODEL 186 Shown at left is tooled for marking 5 inch High Explosive shells.

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Marking specialists since 1904
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MARK IT BEST WITH NOBLEWEST® NOBLEWEST IMPROVED MARKING DEVICES

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By producing on ferrous rods and wire a non-hygroscopic, ductile, crystalline coating, Oakite CrysCoat No. 86 adsorbs and retains die lubricants. In addition, Oakite CrysCoat No. 86 combines chemically with surfaces treated to provide additional lubrication.

Among the proved advantages resulting from the use of Oakite CrysCoat No. 86 are increased production through less frequent changing or replacing of dies, longer die life, uniformly excellent wire appearance, shorter downtime of equipment. Complete details gladly sent on request.

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1901 SOUTH ROCKWELL STREET • CHICAGO 8, U. S. A.

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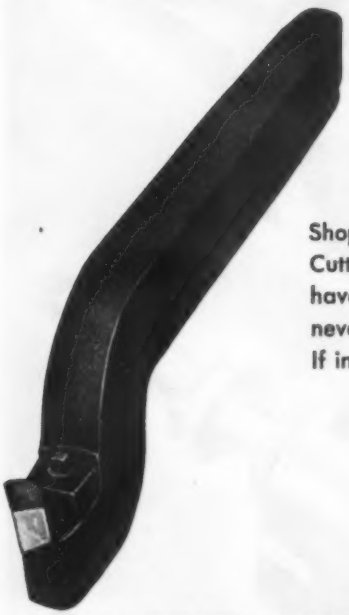

The first thing that goes out when the O K System goes in is "trick" tool grinding. The O K tool bits are scientifically shaped for maximum metal removal and grinding is practically fool-proof for most jobs. It is only necessary to dress up the cutting face; the *shape* preserves the side clearance.

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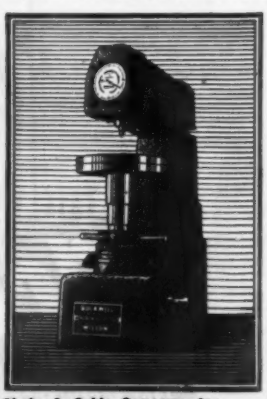
The word ROCKWELL has been our Trade Mark for 24 years and is the mark that insures precision.



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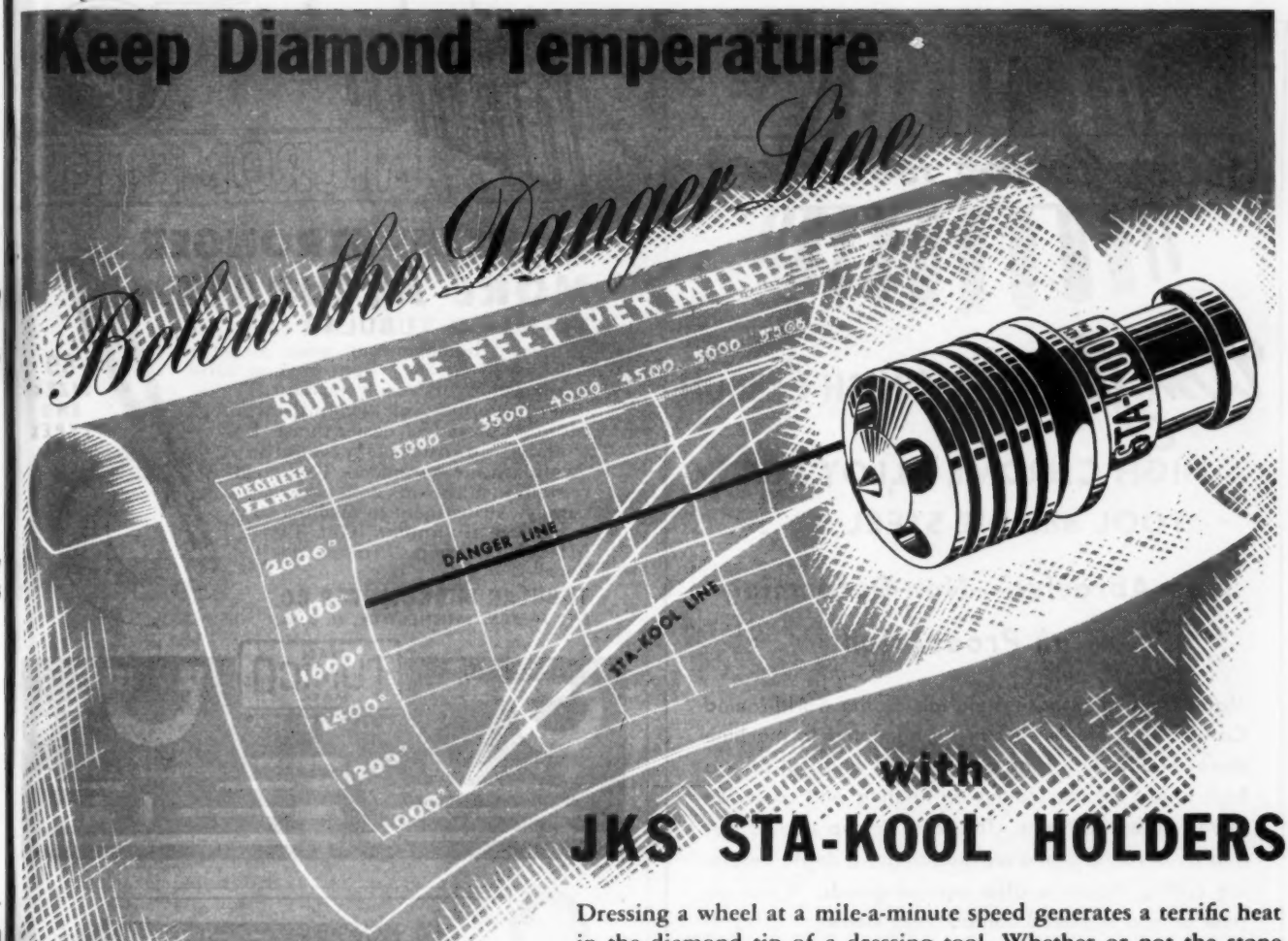
Below the Danger Line



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Dressing a wheel at a mile-a-minute speed generates a terrific heat in the diamond tip of a dressing tool. Whether or not the stone becomes red hot, heat can play havoc with a diamond — cause checking and reduce strength even after proper resetting.

In a single point diamond tool . . . where four-fifths of the stone is generally set below the surface collecting heat and transmitting it to the holder . . . the J. K. Smit & Sons patented STA-KOOL holder removes all possibility of damage from overheating. Its internal ducts and fins allow quantities of coolant to pass around, through and under the metal setting. Setting and enclosed portion of the diamond are efficiently cooled. Excess heat created in the diamond point has no chance to accumulate inside the tool, but instead is dissipated in the larger cooled portion of the stone and setting. With proper use of the correct size STA-KOOL tool for the job, temperatures never rise above the Danger Line. Specify STA-KOOL holders . . . available for all makes of machines.

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Alloy "C" Steel is admirably suited for all classes of blanking, drawing and trimming dies and punches. It is specially recommended for the hobbing tools used for making dies for moulded plastic products.

Full details on recommended heat treatment available on request.

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TU-MI-CO TUBULAR construction of special homogeneous grain structure steel is 25 to 50% lighter than solid frame, yet highly shock resistant. Triple plated—copper, nickel and chrome More sensitive feel, easier to use. Low thermal conductivity—combats "walk" in measurement. Tool steel spindle with threads *ground* for accuracy. Adjustment in bushing to maintain alignment Get TU-MI-CO precision. Prompt delivery

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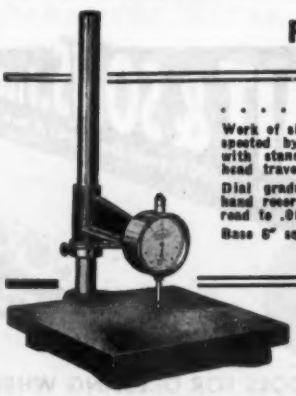
The RANDALL & STICKNEY Platform Gauge



. . . . takes work up to 7 inches

Work of similar size can be quickly and easily inspected by setting gauge head at desired height with standard block or plug. Spindle on gauge head travels ½".

Dial graduated 0 to 50 in thousandths; second-hand records 10ths of inches. Can be furnished to read to .01 mm.

Base 6" square; height 13"; weight 18½ lbs.

Investigate Now!

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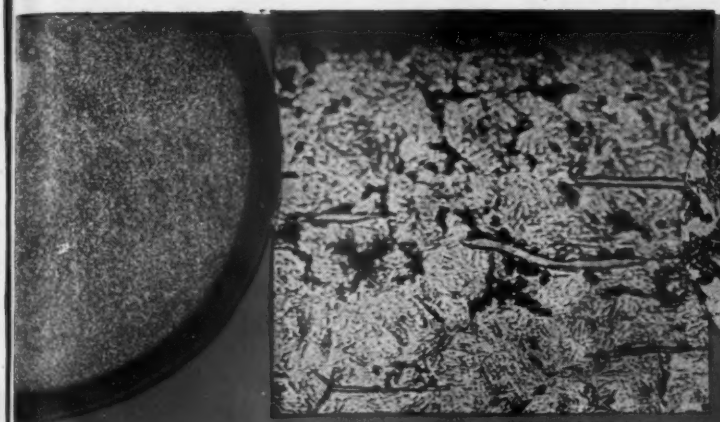

Fig. 1. *Macrostructure*—Dark circumferential area is the hardened portion of the steel.

Fig. 2. *Surface of Shaft*—Medium-coarse grained martensite; dark areas of troostite. Manganese sulfide stringers.

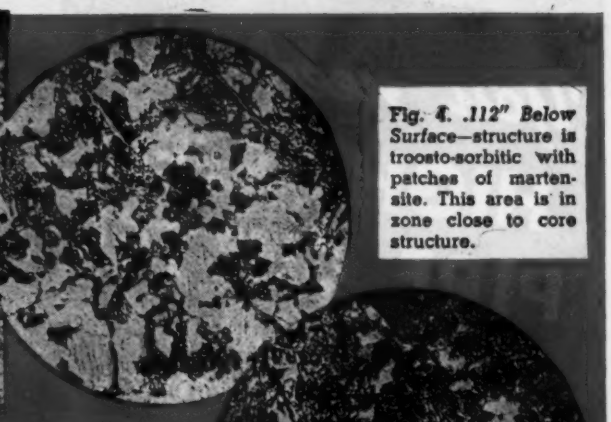

Fig. 3. *.060" Below Surface*—light areas of medium-coarse grained martensite and dark areas of troostite.

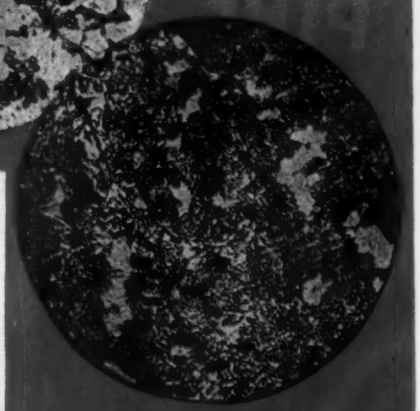

Fig. 4. *.112" Below Surface*—structure is troosto-sorbitic with patches of martensite. This area is in zone close to core structure.

Fig. 5. *Core Structure* — medium-coarse grains of pearlite, lamellar pearlite and ferrite. Manganese sulfide stringers are uniformly distributed throughout. Structure is unchanged by hardening operation.

LEPEL *High Frequency* INDUCTION HEATING MAKES CONTINUOUS SURFACE HARDENING OF SHAFTING AND TUBING PRACTICAL.....

Induction heating with the Lepel High Frequency Unit dispels the notion that very heavy and expensive equipment is necessary for continuous surface hardening of shafting and tubing.

- Lepel spark-gap-operated equipment, generating frequencies of 100,000 to 450,000 cycles, creates heat so rapidly that continuous progressive heating and quenching is practical with normal current input. Shafting or tubing up to 3" diameter can successfully be heat treated with a standard 30 KW unit.
- Slow rotation of shaft during heating and quenching develops highest uniformity consistent with chemistry of the steel.
- Heating is so rapid and the time at heat so short that even normal grain growth associated with conventional heat treating methods does not take place. This makes it possible to use ordinary carbon steels in many applications where alloys heretofore have been required.
- High frequency induction heating develops a super-hard skin which provides superior wearing qualities.
- The speed of heating and the short time at heat prevents surface decarburization and scaling. Ground shafting and tubing may be hardened without the need for finishing after quenching.
- Due to the short heating and quenching cycle, the core structure is unchanged and highest ductility is maintained.
- Depth of hardness can readily be controlled by adjusting the input power or varying the travel speed of the part through the heating coils.
- Distortion is minimized, regardless of the length of the part.

Any hardenable steel can be heat treated with equal assurance of satisfaction. The photomicrographs illustrate the results obtained with a steel of the following analysis:

Carbon	.35/.45
Manganese	1.35/1.65
Phosphorus	.045 max.
Sulphur	.20/.30

In the illustration below, a 2" shaft 17" long is being hardened by passing it progressively through the heating coil and quench ring. Horizontal travel is 2½ feet per minute and the shaft is rotated as it travels forward. Quenching temperature is 1500/1550° F with a water quench.

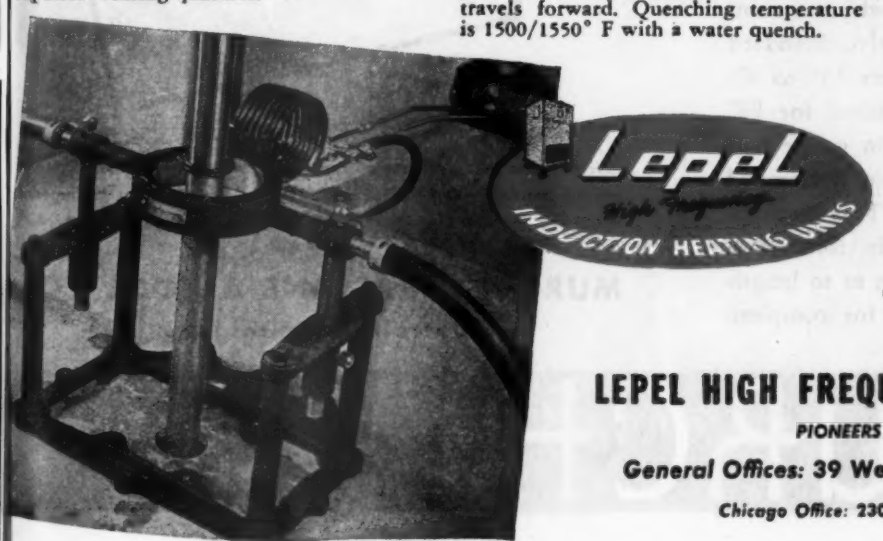

Fig. 1 shows the macroetched section of the shaft at approximately 1.5X magnification, indicating a penetration of 5/64". Only the surface yields the full hardness, Rockwell C60/C61, the Rockwell reading declining to C40 as the core is approached.

Figures 2, 3, 4 and 5 (500X magnification) show the grain structure at the surface, .060" and .112" below the surface and at the core respectively.

The same Lepel Unit can also be used for localized hardening, stress relieving, normalizing, brazing and soldering.

If you have a problem of surface hardening steel shafts or tubing of any length, Lepel engineers will be pleased to show you how you can not only secure better results, often with lower-priced steels, but also effect important economies in hardening cost and production time.

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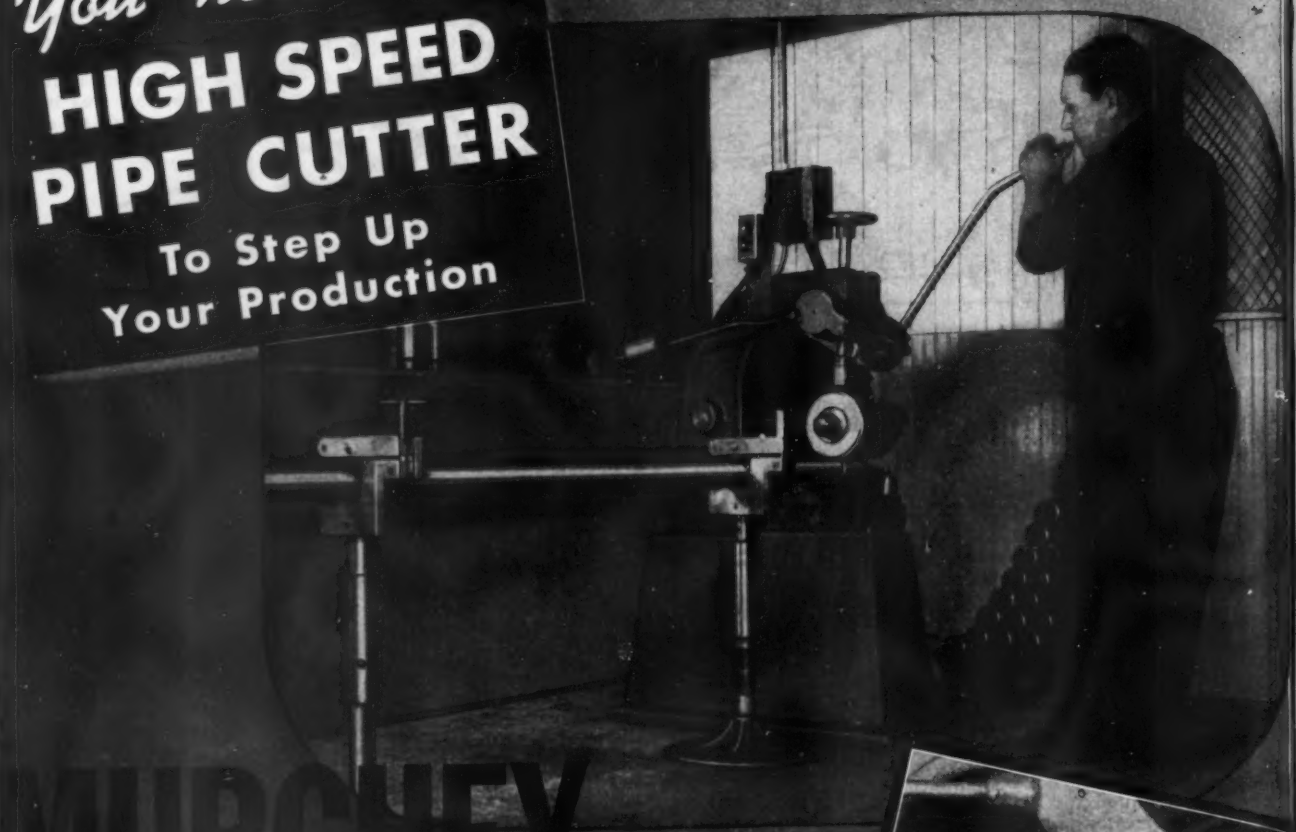

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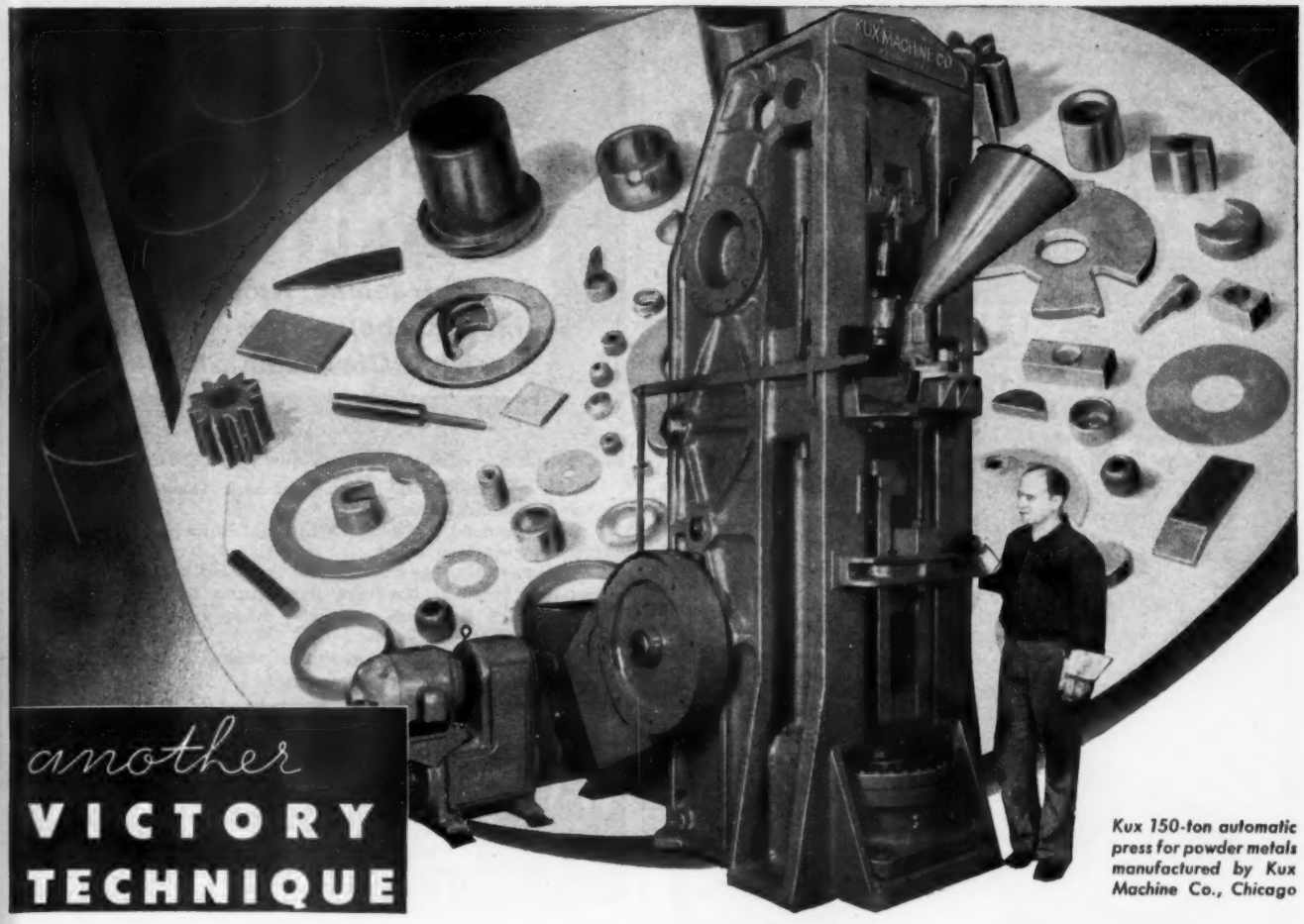

another
VICTORY TECHNIQUE

Kux 150-ton automatic press for powder metals manufactured by Kux Machine Co., Chicago

A NEW NOTE IN THE METALLURGICAL SYMPHONY...
Powder METALLURGY

BEFORE the ancients worked with molten metal they fabricated simple implements from metal powder. Yet it was not until the vast needs of World War II that the development was forced to practical proportions. Now thousands of parts pressed from powdered metals and sintered in a controlled atmosphere furnace are being used in weapons of war and accessories at a great savings of time or cost or both.

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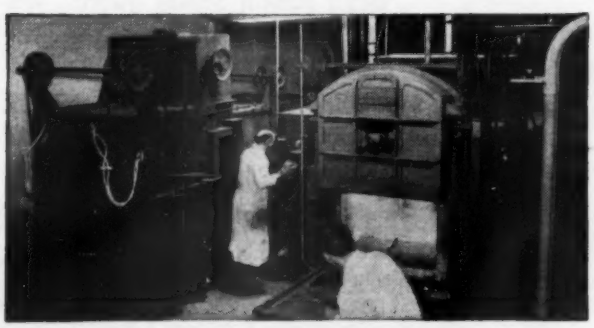

A Battery of Lindberg Brazing Furnaces in operation

ARMY E NAVY

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A tool steel with an original basic formula of our own specifications.

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Ideal for blanking, drawing, forming, trimming and shearing tools.

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JUNKIN SAFETY GUARDS

FOR UTILITY
INVESTIGATE THE U.S. MULTI MILLER

THESE various illustrations serve to illustrate the adaptability of the U. S. Multi-Millers for handling a wide variety of milling operations on small and medium sized parts.

Two versatile accessories contribute to the all 'round utility of these machines—the MV-1 U. S. Quick Loading Vise and the U. S. 180 degree Hand Index Table. These units can be mounted directly to the table of U. S. Multi-Millers. The vise, by means of different sets of formed jaws, can be used for handling many of the simpler milling operations. The 180 degree index table is used to reduce lost time due to loading. Two separate work holding fixtures can be mounted 180 degrees apart on the index table. While the work pieces in one fixture are being milled, the operator loads the fixture at the opposite end of the index table. When the cutting cycle is completed, the operator indexes the table by hand to present the previously loaded pieces to the cutters for the next cycle. This affords an efficient and economical set-up.

The photographs at the right illustrate a few of the more complicated operations handled on the U. S. Multi-Millers.

From the top down these illustrations show:

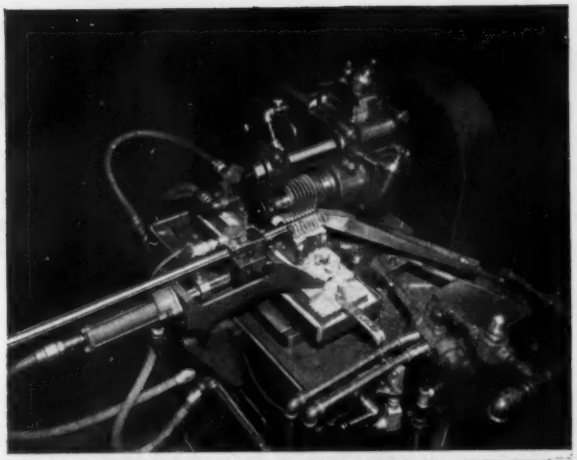
1. U. S. Multi-Miller equipped with hydraulically operated bar feed mechanism and clamping fixture for automatically cutting off pieces in multiple from bar stock.

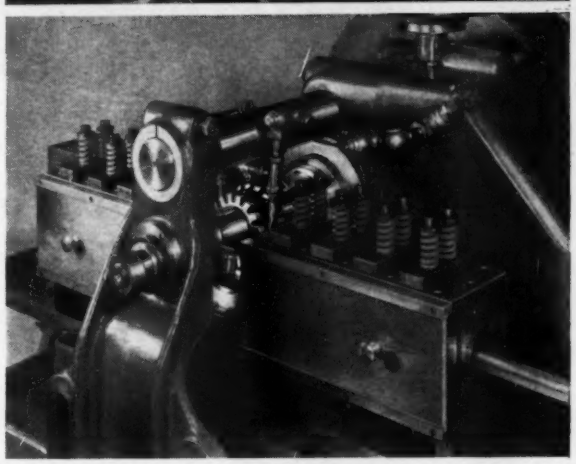
2. Individually motor driven continuous milling fixture mounted on U. S. Multi-Miller. The fixture is equipped with formed power-driven feed-in and take-out rolls to control the movement of the bar or strip stock through the fixture. This type of equipment can be used to advantage for milling a form in bar stock, eliminating the necessity of purchasing extruded stock.

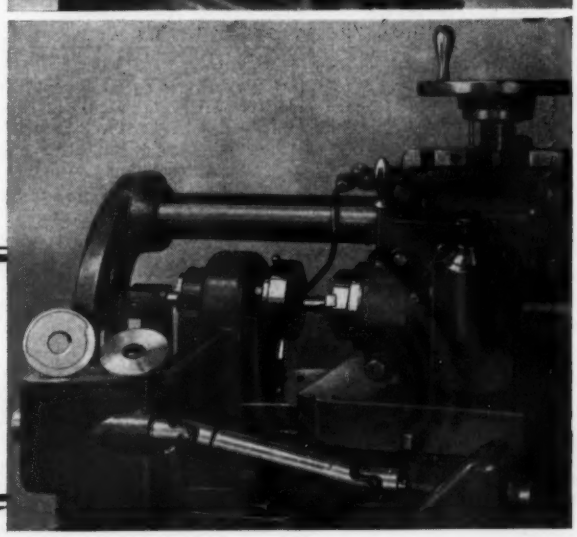
3. This photograph shows a U. S. Multi-Miller equipped with automatic indexing fixture. This type of equipment can be used for milling equally spaced slots or grooves around the periphery of circular parts. A six-station type of fixture is used for hex milling.

4. A special fixture mounted on a U. S. Multi-Miller. This automatic fixture is used for milling the cam track in the part shown in the illustration.

Our General Catalog A contains complete specifications for the U. S. Multi-Millers. *Ask for your copy.*







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AMPERE (East Orange), N.J.

Builders of U.S. MULTI MILLERS — U.S. MULTI SLIDES
U.S. AUTOMATIC PRESS ROOM EQUIPMENT
U.S. DIE SETS AND ACCESSORIES

YOU CAN MEET ANY TAPPING REQUIREMENTS

with

Ettco-Emrick TAPPING ATTACHMENTS

• MADE IN 7 SIZES FOR NO. 0 TO 1" TAPS •

ETTCO-EMRICK TAP CHUCKS

Centers taps on the round and clamps them on the square. Grip is visible assuring proper insertion every time. 5 sizes for No. 0 to 1" taps. Details in Bulletin No. 6.

On any job within their range where the right taps are used and the other essentials of good machine tapping are met, you can do *as fine a tapping job with Ettco-Emrick Attachments on your drill presses as with any other method*—a job that will satisfy any commercial tapping requirements.

The best evidence of this is the fact that we have been producing these tappers for 25 years, and the demand for them has grown steadily year after year. Thousands of them are in use today in shops throughout the country.

SEND FOR BULLETIN NO. 2

It will give you details about the supersensitive friction clutch and other features which make Ettco-Emrick Attachments the equal of any other method for fast, accurate tapping.

Write for your copy today.

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590 Johnson Ave., Brooklyn 6, N. Y.

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The Famous Ettco-Emrick DRILL CHUCKS • TAP HOLDING CHUCKS
TAPPING ATTACHMENTS • TAPPING MACHINES
MULTIPLE SPINDLE TAPPING AND DRILLING HEADS
Unexcelled for Design, Materials and Workmanship

DURABILITY WITH Precision!

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• Like the great B-24, Master Gauges are constructed of the finest materials and to the highest precision. That's why our customers are so pleased with the service they get from our gauges.

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THREAD RINGS
PLAIN PLUGS
PLAIN RINGS
SNAP
FLUSH PIN
PROFILE
BUILD-UP
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JIGS, DIES AND FIXTURES

MASTER GAUGE CO.

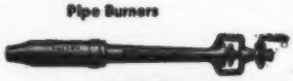
BUZZER Gas BURNERS

Reg. U.S. Pat. Off.

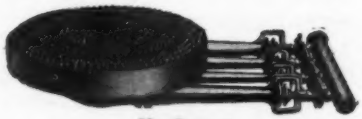
For Many Industrial Gas Uses

NO BLOWER or POWER NECESSARY
. . . just connect to gas supply

Pipe Burners



Nozzle Burners



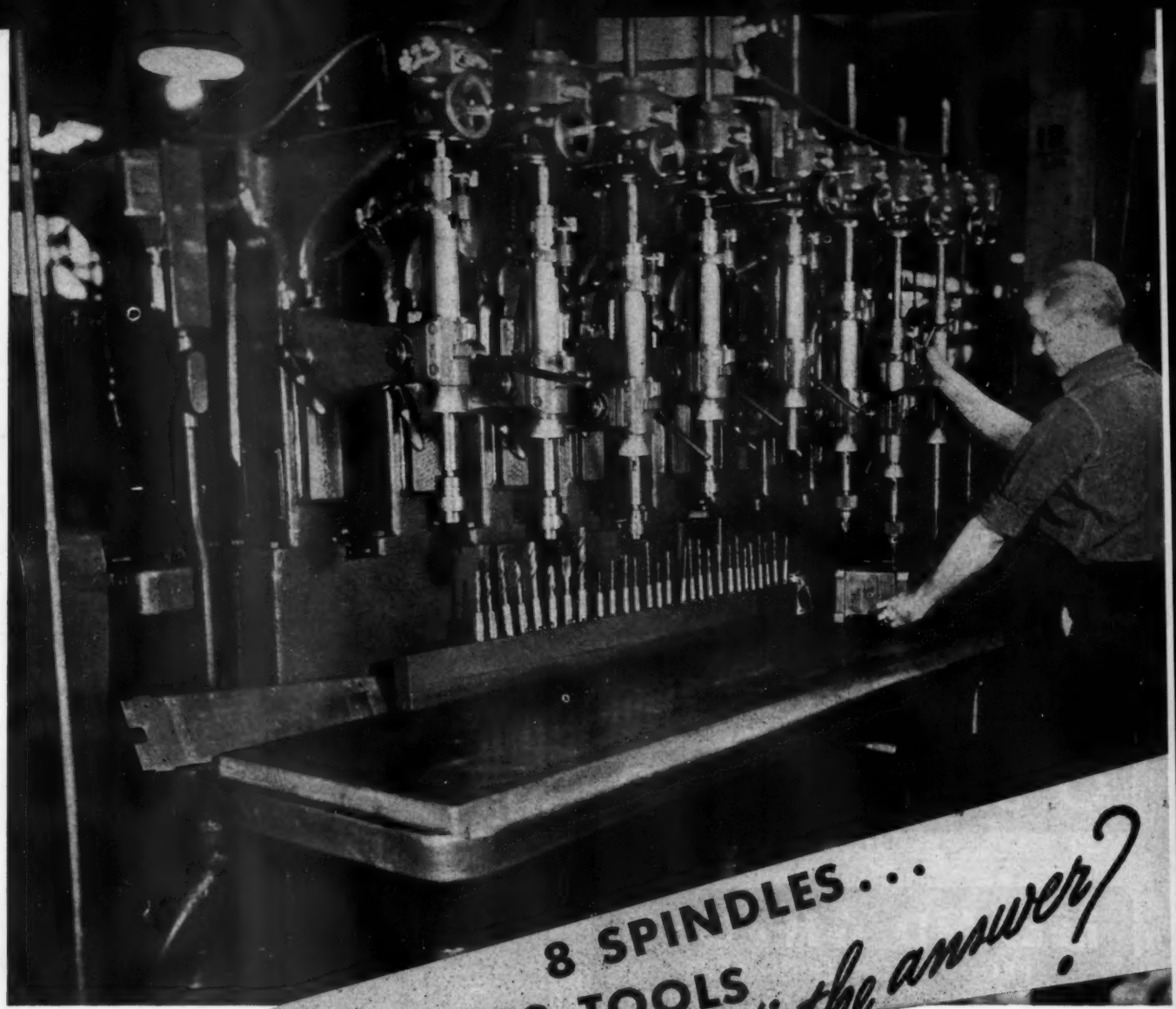
Ring Burners

Designed to solve numerous Industrial Gas applications, "BUZZER" Burners are unexcelled for Efficiency, Economy, Simplicity and Flexibility. Large variety of models available.

Send for the "BUZZER" Catalog showing complete line of Industrial Gas Burners, Furnaces and other equipment.

CHARLES A. HONES, INC.

121 So. Grand Ave. Baldwin, L. I., N. Y.



8 SPINDLES . . .
32 TOOLS
What's the answer?

MODERN-MAGIC
CHUCK AND COLLET EQUIPMENT

The above set-up is a typical example of what can be done with MODERN Magic Quick Change Chuck and Collet equipment. Here, four spindles of the machine, equipped with MODERN Magic Chucks, perform twenty-eight separate operations.

The twenty-eight tools are easily and quickly changed without stopping or even slowing the machine. Bulletin M-101 gives complete details on MODERN Magic Quick Change Chuck and Collet equipment. Send for your copy today.

PROMPT SHIPMENT . . . . . USUALLY MADE FROM STOCK

MODERN TOOL WORKS

DIVISION OF
CONSOLIDATED MACHINE TOOL CORPORATION
ROCHESTER 10, NEW YORK

"WALKERS" . . . at work

One of a series of advertisements showing specific machines on which Walker Magnetic Chucks are being used and the operations being performed.

Hanchett Rotary Surface Grinder, showing loading of work on Walker Rotary Magnetic Chuck.

Speed up in production is aided by WALKER MAGNETIC CHUCKS

Down through the years, the inherent productivity of the Hanchett Grinder has been aided and exacting standards of quality maintained by the use of dependable WALKER CHUCKS.

The fact that industry is turning more and more to the use of Magnetic Holding devices to replace costly, time-consuming mechanical fixtures is outstanding evidence that the "Walker Way" is the modern way to speed production and meet close tolerance requirements.

Walker chucks are now available in Permanent Magnetic Plain and Swivel Types as well as in Electro-Magnetic types of new design. Investigate.

Your Machine Tool Builder, working with Walker engineers is prepared to help you solve your problems.

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PRODUCTION ENGINEERS
at these Branch Offices will help you with your
DRILLING PROBLEMS.

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WORCESTER, MASS.
for New England

LELAND GIFFORD
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LUERS

Patented Cutting Off Tool Holders
Patented Cutting Off Blades

ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips — MEANS MAXIMUM CUTTING EFFICIENCY.

Manufactured By
J. Milton Luers — 12 Pine St. — Mt. Clemens, Mich.
Produced under license issued by John Milton Luers Patents Inc.

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BACK THE ATTACK
***By Buying* WAR BONDS**

Clean Up Dust, Dirt and Litter—Protect Valuable Equipment—Promote Efficiency—with the Powerful, Portable, One-Man

TORNADO VACUUM CLEANER

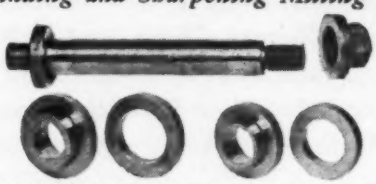
BEFORE dust and dirt damage valuable motors and machinery, clean up floors, walls, ceilings and overhead beams and pipes with TORNADO. Powerful suction insures quick cleanup. 1 h.p. G. E. motor, 49" waterlift, 175 c.f.m. Attachments for cleaning everything.

Request details and FREE TRIAL Offer

BREUER ELECTRIC MFG. CO. 5084 N. Ravenswood Ave. CHICAGO 40, ILL.

GRINDING ARBOR

for Grinding and Sharpening Milling Cutters



Made of SPECIALLY SELECTED STEEL—Heat treated and Precision ground. SAFETY CENTERS.
Designed for 1" hole cutters, furnished with 2 extra bushings and collars for 1¼" and 1½" hole cutters.
Mfg. by Circle Tool & Gage Co.
Sold Exclusively by

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Some territory still open—Write for leaflet M3
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WHY WELDERS TAKE PAGE QUALITY FOR GRANTED

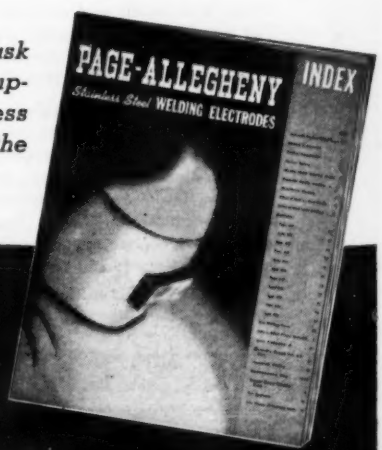
For the ticklish welding job—or any welding job for that matter—good results demand uniform electrodes.

PAGE believes that there is only one way to get real uniformity. And that is by rigid factory control of analyses, wire drawing and coating—constant factory test of welding results.

That's the **PAGE** way of making electrodes. And that's why those who know and use them take **PAGE** quality and uniformity for granted.

PAGE offers a wide range of electrodes and gas welding rods. Your **PAGE** distributor offers you the advantage of long experience in selecting the one best rod for each job.

Call your **PAGE** *distributor and ask for a copy of this new, informative, up-to-date booklet on welding stainless steel. Or, if you prefer, write to the factory for your copy.*



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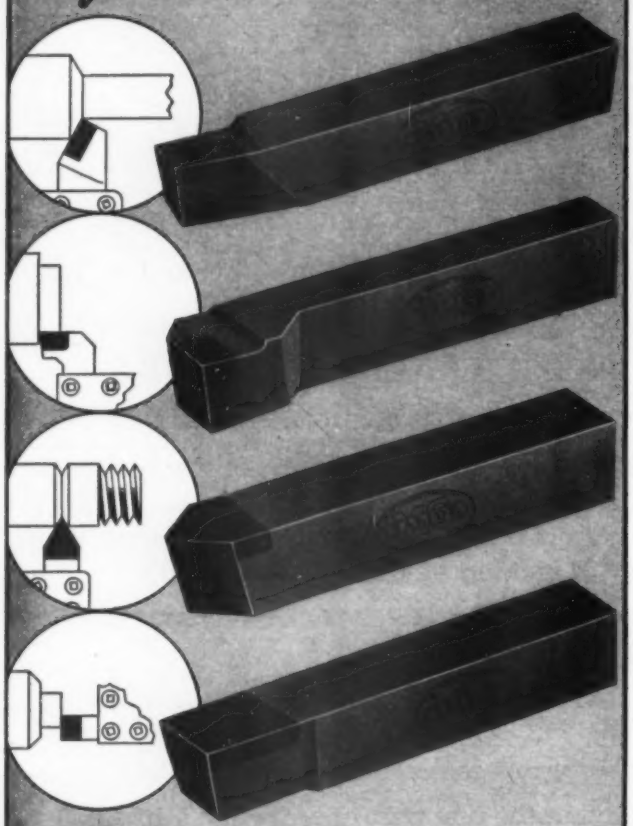
ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Los Angeles, New York, Pittsburgh, Portland, San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

TALIDE TOOLS for Higher Speed Production!



Talide-Tipped Tools are increasing the output of all kinds of machined parts because they cut faster, last longer and produce a better finish. The extra hardness, density and toughness of Talide Tips make their use universal for both heavy hogging and fine finishing work.

Reduce your cost of machining hard castings, steel forgings and other precision parts by using Talide-Tipped Tools to produce more pieces per grind—in less machine time. Available in both Tungsten Carbide and Tungsten-Titanium Carbide compositions, Talide-Tipped Tools give longer run, higher speed performances on all types of boring, facing and turning operations.

Send for Catalog 44-T listing Standard Tools and Tips.

TIPPED WITH TUNGSTEN CARBIDE

METAL CARBIDES CORPORATION TALIDE YOUNGSTOWN, OHIO

METAL CARBIDES CORPORATION
YOUNGSTOWN, 5 OHIO
TUNGSTEN CARBIDE TOOLS · DIES · WEAR PARTS

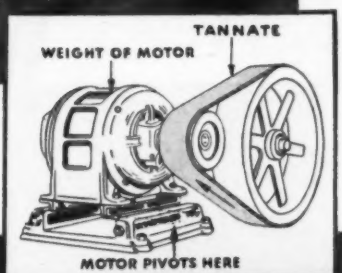
Why the Automatically CONTROLLED Belt Tension of the TANNATE-ROCKWOOD Drive provides *Greater Efficiency . . . Lower Maintenance!*

The Tannate-Rockwood Drive provides a simple means of maintaining correct belt tension. Too little tension permits a belt to slip . . . wastes power—too much tension causes wear on both belt and bearings.

The Tannate-Rockwood Drive avoids both of these conditions by assuring correct tension automatically . . . by the weight of the motor on the pivoted Rockwood base. It is carefully designed to do just that.

The Tannate Belt, because of its great strength and flexibility and unusual endurance keeps maintenance costs down . . . assures long life.

Get a Tannate-Rockwood Drive for floor, wall, ceiling, or vertical drives using small or large motors. *Get more details now.*

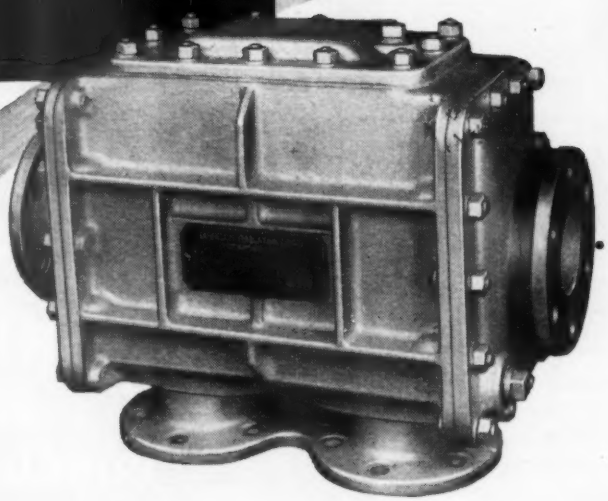


A vertical base type Tannate-Rockwood Drive operating a lathe in a metal working plant.

RHOADS *Tannate-Rockwood* **SHORT CENTER DRIVE**

J. E. RHOADS & SONS
35 N. SIXTH ST. PHILADELPHIA 6, PA.
NEW YORK • CHICAGO • ATLANTA

HARRISON
OIL COOLERS



Help Eliminate Shutdowns–
Costly Repairs

When lube oil temperatures become too high, there is the probability of damage to tools and machines, resulting in costly repairs and loss of much needed war production.

If oil temperatures are kept within bounds, proper lubrication is insured—excessive wear eliminated—and production stepped up.

In many types of industrial applications, the installation of Harrison Oil Coolers has achieved these results.

Write for recommendations regarding your specific heat control problem.

HARRISON

HARRISON RADIATOR DIVISION OF GENERAL MOTORS, LOCKPORT, NEW YORK

Don't Quit Now—
BUY WAR BONDS

3 NEW CLAMPS
added to
KNU-VISE LINE

MODEL KV 216 — *Having straight base, this model offers wide range of mounting possibilities — upright, on side, or at any angle.*

MODEL KV 210 — *An improved light-duty, large-capacity clamp used principally in aircraft, automotive equipment, machinery and furniture clamping.*

MODEL KV 221 — *Especially designed for cases where extra pressure is required for clamping at angle to base.*

Typical of all Knu-Vise Clamping devices — these clamps are designed to provide speed in clamping. Once set for desired pressure, the clamps apply pressure instantly and release it just as quickly with one lever motion.

BUY MORE BONDS

KNU-VISE INCORPORATED

2217 Eighth St., Detroit 16, Michigan
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IN PARALYZING COLD

OR BLISTERING HEAT

KESTER CORED SOLDERS

Stay put

- On every exacting soldering job, Kester Cored Solders are made to stand up under severest operating conditions. Day after day, over the Arctics and Tropics, they're holding tight under the temperature extremes faced by Uncle Sam's fighting planes.
- Heat, cold, vibration, shock, bending—none of these affect a Kester solder-bond.
- Electrical circuits installed with Kester Rosin-Core Solder are free from terminal resistance. The plastic rosin flux won't cause corrosion, nor injure insulating material.
- Kester Acid-Core Solder, used for general applications, makes a tight, clean, permanent union—an important safety factor—one which makes for long trouble-free service.
- Consult Kester engineers without obligation, on any soldering problem.

☆ **BUY WAR BONDS** ☆

KESTER SOLDER COMPANY
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Eastern Plant: Newark, N. J.
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KESTER
Cored Solders
STANDARD FOR INDUSTRY

CONTRACT WORK

PLANT EMPLOYING 200 PEOPLE HAS PRODUCTION TIME OPEN

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- TURRET
- MILLERS
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- GRINDERS
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Over 200 Machine Tools

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SPECIAL ENGINEERING WORK

ON A CONTRACT BASIS . . .
exactly to your specifications . . .

A complete and efficient service for the manufacture of machines and parts, special tools and fixtures, etc., is available to you in our modern, fully-equipped shop. We also offer cam milling facilities that will fit your requirements. You are guaranteed quality work at a reasonable cost.

Send your blueprints or samples today for prompt quotations at no obligation.

Designers and builders of wire and ribbon stock forming machines.

THE A. H. NILSON MACHINE CO., Bridgeport, Conn.

SCREW MACHINE PRODUCTS

STEEL—BRASS—ALUMINUM

MACHINE SHOP FACILITIES

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STAMPINGS AND ASSEMBLIES

Fast Service on Long or Short Runs

"GREATER SAVINGS WITH GREIST"

We can handle your stamping and assembly requirements in any metal. Our modern equipment and methods coupled with 50 years of experience is your guarantee of accuracy and efficiency. Our facilities include capacity for handling screw machine products, tools, dies, jigs and fixtures.

Quality work by skilled mechanics is assured. Send your blueprints or samples today for prompt quotations!

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METAL STAMPINGS
• TOOLS • DIES •
PERMANENT MAGNETS
HEAT TREATING
THOMAS & SKINNER
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HIGH PRODUCTION
MILLING — DRILLING — GRINDING
24 hr. service on
TOOL AND CUTTER GRINDING
Experimental Work — Background — Instrument — clock mfg.

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PROSPECT HEIGHTS RENSSELAER, NEW YORK

• TOOL DESIGNING AND BUILDING • MACHINES DESIGNED • IDEAS DEVELOPED • PROMPT—EFFICIENT—SERVICE • • REASONABLE CHARGES •

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Write — Phone or Telegraph

AVAILABLE SCREW CAPACITY
¼ to 4½ Automatic and Hand Screws
Including Necessary Secondary Operation
Forward Samples and Blueprints for Quotations
BRIDGEWATER SCREW PRODUCTS CO., Bridgewater, Mass.

PRECISION FORM GRINDING

Specialists in grinding Circular and Flat FORM-TOOLS, FORM Counterbores, FORM Flat-Drills, and related types of FORM grinding. Also step-grinding of Tungsten and Molybdenum Rods.

Send Prints for Quotation and Delivery

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(Makers of J.&S. Radii & Angle Dressing Tools)

WIRE AND METAL SPECIALISTS
In round, flat, square and special shaped wire in all metals.
LARGE PRODUCTION CAPACITY
Plating and finishing.
EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us – we will take care of them.
GENERAL PATTERN WORKS
2233 Burk Street Cincinnati, Ohio

INVENTIONS SOUGHT

Will pay cash or royalty for inventions that would sell to consumers for about $1.00 up to $100.00. Automotive parts and tools, Tire tools, any kind of repair tools, Household articles or small machines.

CONTRACTORS

Let us quote on your subcontracts. TURRET LATHES UP TO 3½" BAR FEED. Engine lathes up to 18" Swing. Milling machines up to 36" tables. Grinding, Welding and other supporting equipment.

DEMERS MACHINE PRODUCTS CO.
331 PLEASANT STREET WORCESTER, MASS.

BUILDERS OF SPECIAL MACHINERY TOOLS & DIES

THE SPECIALTY MACHINE TOOL & DIE CO.
923 Market St. (Rear) Wheeling, W. Va.

POSITIONS VACANT

DRAFTSMAN EXPERIENCED with drawing dies, tool and jig layout, post-war positions, excellent conditions. P-164, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

MECHANICAL ENGINEER—Old established company now converted to pre-war production (essential products) has opening for mechanical engineer with some machine design, factory lay-out, and installation experience. Excellent future possibilities. Give complete details of personal qualifications and work history in letter of applications. P-205, American Machinist, 330 W. 42nd St., New York 18, N. Y.

SPRING MAKER in short order department. High wages. Now on war work but post-war work and position assured. Give full details of qualifications, prior experience, age, and references. P-230, American Machinist, 330 W. 42nd St., New York 18, N. Y.

WANTED ESTIMATOR—An old, well established tool shop in Northern Ohio desires the services of a man thoroughly capable of estimating jigs, fixtures, gages, dies, special machinery. Position permanent. Should you have this ability, write giving full background as to experience, education, draft status, and former positions held. Compensation open. Write P-236, American Machinist, 330 W. 42nd St., New York 18, N. Y.

WORKS MANAGER. Small, light manufacturing metal trades plant. St. Louis location. Fine opportunity. Give fully age, experience, references, salary expected. P-244, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: Die shop foreman, die sinkers and maintenance men. Salary negotiable according to qualifications. Statement of availability required. P-245, American Machinist, 330 W. 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS—This advertising service of 35 years recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 366 Delaware Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

MECHANICAL ENGINEER with 28 years' executive experience. Successfully filled such capacities as Chief Engineer, General Superintendent and Works Manager. Well versed in modern manufacturing methods and equipment. Past connections with large well known concerns producing such products as sewing machines, machine tools, automobiles, aircraft and aircraft engines. Responsible position desired in Eastern location. PW-219, American Machinist, 330 W. 42nd St., New York 18, N. Y.

ENGINEER EXECUTIVE—Wants permanent position with reliable firm. Experience in metal fabrication and machine operations; industrial engineering; tool and welding engineering; product engineering and development; labor problems and supervision; and management organization. PW-231, American Machinist, 330 W. 42nd St., New York 18, N. Y.

ACCOUNTING-MECHANICAL Executive. Man with 16 years' experience in machine shop and toolroom work and 12 years' experience as a public accountant, seeks a position with a well-financed company where his past experience will be valuable. Organization, managerial and instructional training experience. Efficiency minded. Free to travel. Detailed experience upon request. PW-234, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

MANAGER OR Superintendent—Graduate mechanical engineer, graduate apprentice machinist, age 37, with 12 years' experience in mass production lines with a large well known company. Qualified in metal fabrication, engineering development, methods, layout, and supervision. Capable of efficiently setting up and running an existing or proposed manufacturing plant. Desires temporary or permanent position with a small progressive company. Minimum salary $8,000. Write PW-247, American Machinist, 330 W. 42nd St., New York 18, N. Y.

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In Engineering, Manufacturing, Sales & Administration, we offer, AT NO CHARGE, a confidential, dignified opportunity of bringing their qualifications before interested employers.
Inquiries from management for key men are invited on a retainer or fee basis.

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EAGLE KNITTING MILLS INC.

has a permanent position to offer with an excellent future for an experienced

SEWING MACHINE MECHANIC

with creative ability. This is an opportunity to establish yourself with a well known knitted outerwear manufacturer.

EAGLE KNITTING MILLS INC.

507 S. 2nd St., Milwaukee 4, Wis.

WANTED FOR ENGINEERING DEPARTMENT

Machine designers, layout men and detailers familiar with design of medium and heavy machinery. State qualifications. Location—Midwest City.

P-227, AMERICAN MACHINIST
520 North Michigan Avenue
Chicago, Ill.

WANTED
PRODUCTION MANAGER

Thirty to forty-five years old. Must have successful production record. Midwest firm with forty years background has capacity orders for postwar manufacturing of our regular line of precision made construction and mining tools. Give age, experience and minimum salary expected.

P-243, AMERICAN MACHINIST
520 North Michigan Ave., Chicago 11, Ill.

MECHANICAL ENGINEER
WANTED

Established Company—75 years old. Located Newark, N. J. Small Carbon Steel products essential to everyday life has desirable opening. Party will operate direct with ownership management. Give complete details of personal qualifications and work history in your letter of application. Now doing essential war work.

P-242, AMERICAN MACHINIST
330 West 42nd St., New York 18, N. Y.

POSITIONS WANTED

CHIEF INSPECTOR, wants connection with modern concern. 15 years' experience in metal fabrication. Mechanical background, age 40. Prefer new product. Would like to set up organization and trains new employees. At present employed, available. PW-246, American Machinist, 520 N. Michigan Avenue, Chicago 11, Ill.

SHOP SUPERINTENDENT, 20 years' experience on progressive dies, layout and development, estimating, process engineer. Thoroughly familiar with high speed automatic roll feed equipment, 4-slide machines, and die casting. Ex-service man, family of 3. PW-248, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

BUSINESS OPPORTUNITY

PUT YOUR Patents to work. Responsible firm of 22 years' experience in patents and licensing, desires items for development. Prefers ideas adaptable licensing exclusive basis. Will buy outright or take exclusive franchise. Can develop special machinery if necessary. Submit patent or drawings. Explain prospects, competitive products and basis will do business. BO-189, Amer. Mach., 520 N. Mich. Ave., Chicago 11.

PATENT ATTORNEY

PATENTS, COPYRIGHTS, Booklet, "General Information concerning Inventions and Patents" and "Free Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N. W., Washington 5, D.C.

WANTED
FOREMAN

Concern in the Ohio Valley wants a young aggressive and productive foreman for their Frog and Switch Shop. This is a permanent position for post-war. State age, experience, salary and availability. All replies kept confidential. Reply

P-239, AMERICAN MACHINIST
520 North Michigan Ave., Chicago 11, Ill.

EXCEPTIONAL OPENING FOR
SALES ENGINEER
IN METALWORKING INDUSTRY

Selling Experience Desirable
But Not Essential

Nationally known manufacturer of production material wants man to advise customers on applications — not take orders. Salary to be commensurate with experience.

Requirements: Varied knowledge of metalworking production gained by plant work or selling; ability to travel away from home. Write in detail about background; enclose photo. Interview arranged at New York headquarters, expenses paid, if necessary.

SW-238, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

SALESMEN

Industrial hardware or allied experience. Manhattan, Bronx, Westchester, Connecticut and New Jersey areas. Own car. Post War. Salary, bonus, expenses.

SW-240, AMERICAN MACHINIST
330 West 42nd Street, New York 18, N. Y.

WE WILL BUY

a going industrial business for cash, and for our own account. Prefer a transaction involving over $100,000.00.

Write to
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TRIPLEX MACHINE TOOL CORP.
WORLD-TELEGRAM BLDG.
NEW YORK 7, N. Y.

POST-WAR PRODUCTS WANTED

By established manufacturer with extensive engineering, toolmaking and manufacturing facilities. Equipped to design, redesign, engineer and produce any metal item, especially precision instruments. Modern plant with newest manufacturing equipment.

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Suite 617, 1457 BROADWAY, N.Y.C.

BRASS FOR SALE

We have superfluous brass bar stock as follows: 6950 lbs. 1-25/32" Octagon Brass Rods, Navy Specification 47-B-2. Make us an offer.

CALDER MFG. CO., Lancaster, Pa.

(Additional Position Vacant Advertisements on page 340)

ABSOLUTE & UNRESTRICTED

PUBLIC

AUCTION

WEDNESDAY, APRIL 25th, 10:30 A. M.

THE ENTIRE PLANT OF THE

DURSTON GEAR CORP.

ON THE PREMISES

213 MALTHIE ST. **SYRACUSE, NEW YORK**

ENGINE LATHES

Monarch 16" x 54" Geared Head (new in 1942)
Monarch 22" x 72" Geared Head (new in 1942)
Seven American 14" x 36", Q.C.G.
Hendey 14" x 60", Q.C.G.
Two American 16" x 54", Q.C.G.
American 20" x 48", Q.C.G.
Atlas 10 x 36, Q.C.G.

TURRET LATHES

Four No. 4 Warner & Swasey Turret Lathes
Three 24" Gisholt Turret Lathes
Nine No. 6A Potter & Johnson
Two 2 x 24 J&L
Fourteen 3 x 36 J&L

PRODUCTION LATHES

Three Porter & Cable 9 x 20
Two LeBlond 10 x 15 Multi Cut
Four Adams 10 x 20 Short Cut

EQUIPMENT

Three Budget 1 Ton Electric Cranes, Electric Hoists and Track, 60 Foot Motorized Conveyor, Portable Cranes, Hydraulic Lift Trucks, Metal Work Benches, Metal Work Stands, Factory Trucks, Two-wheel Trucks, Vises, Scales, Acetylene Welding Outfit, Electric Motors from 1 H.P. to 50 H.P., Shelving, Exhaust Fans, Fire Extinguishers, Stencil Machines, Time Recorders, Chain Hoists, Belt Lacers, Belting, Pipe Vises, Drafting and Shipping Room Equipment, etc.

MILLING MACHINES

Brown & Sharp No. 2 Universal
LeBlond No. 2½ Universal
Hendey No. 3 Universal
Three No. 1 Kempsmith, Plain
No. 1 Kempsmith Universal
Two No. 2 Kempsmith, Plain
No. 2 Cincinnati, Plain
No. 3 Kempsmith, Plain
Cincinnati 18" Duplex
Becker No. 8 Duplex
Kempsmith No. 33
Four Cincinnati 18" Automatics
Four No. 2 Pratt & Whitney Lincoln Millers
No. 2 Pratt & Whitney Hand Millers
Two No. 6 Whitney Hand Millers
No. 3 Garvin Hand Miller
Two No. 1 U.S. Hand Millers
Three Davenport Hand Millers
No. 1 Pratt & Whitney Power Miller
Gabrielson Miller

GEAR SHAPERS

Sixteen No. 61 Fellows Gear Shapers
Two No. 615 Fellows Gear Shapers, Motor Drive

DRILL PRESSES

Two Cincinnati Bickford 3 Foot Radial Drills
Fosdick 2½ Foot Radial Drill
Eight 24" Barnes
Two 21" Cincinnati Bickford
No. 216 Baker
Five Barnes 20"
Eight Henry & Wright ⅝"
Fourteen No. 999 Delta ½" Drill Presses, Motor Drive

SMALL & PRECISION TOOLS

16" Burton Rotary Table, Pittsburg Testing Machine, Morse Gear Centering Lathe, Sheffield Measuring Machines, Rockwell Hardness Testers, Brinnell Testers, Verneers, Micrometers, Johannson Blocks, Surface Plates, Dial Indicators, Gauges, Dumore Electric Grinders, Die Heads, Portable Electric Tools, High Speed Milling Cutters, Drills, Reamers, Boring Bars, etc.

AUTOMATICS

Cleveland ⅞ x 1¼
Two Cleveland 2 x 18
Cleveland 2¼ x 2¾
Cleveland 2¾ x 3¼
Three Fay 14" Automatics

HOBBING MACHINES

No. 633 Barber Colman Type T Hobbing Machine (new in 1943)
Fourteen No. 12 Barber Coleman

HEAT TREATING

Six Brown & Sharp Carborizing Furnaces
Five Frankfort No. 8 Heat Treating and Drawing Furnaces
One No. 397 Heat Treating Furnace
Cyanide Tank
Water Quenching Tank
Oil Quenching Tank
Pyrometers

OFFICE EQUIPMENT

Flat Top Desks, Typist Desks, Office Tables, Office Chairs, Monroe Calculators, Typewriters, Adding Machines, Addressograph, Metal Safe Cabinets, Metal File Cabinets, Electric Frigidaire, Check Protector, Book Cases, Costumers, Electric Fans, Rugs, etc.

GRINDERS

No. 2 Cincinnati Centerless
Five Norton 10 x 36
Two No. 70 Heald Internal
No. 72 Heald Internal
No. 6 Bryant Internal
No. 2 Brown & Sharp Surface
No. 2 Cincinnati Tool Grinder
Four No. 1½" Tool Grinders
Gisholt Tool Grinder
Evansville Drill Grinder
Besley No. 10 Disc 18"

MULTIPLE DRILLS

Four No. 13 Natco 16 Spindles
Sipp 2 Spindles
Three Avey 2 Spindles
Two Leland Gifford 2 Spindles
No. 30 Natco 16 Spindles
No. 1 Fox Multiple
No. 11 Natco 8 Spindles
Two Allen 2 Spindles

MISCELLANEOUS

Ohio 20" Shaper
Pratt & Whitney 10" Shaper
Four Garvin No. 2 Tapping Machines
Whiton Centering Machine
Lucas 15 Ton Power Press
Two No. 1 Cross Tooth Rounders
No. 20C Racine Hack Saw
No. 1 Racine Hack Saw
Two Warner & Swasey ½" Hand Screw Machines
Two No. 3 LaPoint Broach
No. 80 Niagara Washer
No. 52 Niagara Washer
Pangborn Sand Blasting Outfit

MATERIALS

Inventory consists of parts for the manufacture of heavy truck assembly units and service parts together with all Jigs, Patterns, Dies, Drawings, etc. This unit has been in current production until February 28th of this year. The Service Department is still in operation.

LAND & BUILDINGS

Modern Manufacturing Plant approximately 80,000 square feet; part of buildings one floor plan; Railroad Siding; Loading Docks; Sprinkler System; Power Wiring; Room for expansion; Parking Space; Building located within 10 minutes from heart of Syracuse. Large inventory of Truck Wheeler Units; Division of Durston Gear Co.

ALL TO BE SOLD IN SINGLE LOTS WITHOUT LIMIT OR RESERVE

WRITE FOR DESCRIPTIVE CIRCULAR TO **INSPECTION DAILY PRIOR TO SALE**

HARRIS AUCTION & SALES CO.

813 MAIN ST., CINCINNATI 2, OHIO

COLEMAN HARRIS, AUCTIONEER

WANTED
ENGINEERS
MACHINE
DEVELOPMENT

Graduate engineer or equivalent, experienced in the design and development of special and experimental machines. Men with creative ability required, experienced in such lines as automatic, semi-automatic, or ordnance equipment. Must be thoroughly acquainted with modern methods and shop practices and capable of developing new ideas in conjunction with modern mechanical laboratory facilities.

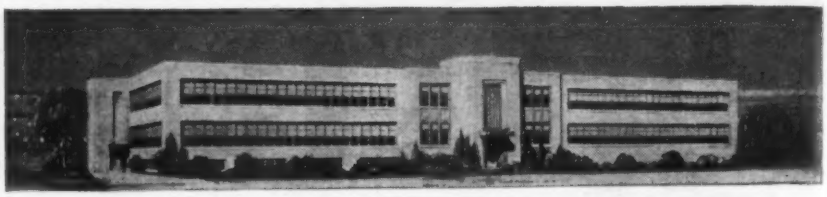
State age, marital status, details of education, experience, draft status, present salary and salary expected. Enclose recent photograph or snapshot.

Post-war opportunity.

Applicants must be able to obtain Statement of Availability.

E. I. du Pont de Nemours & Company, Inc.
Personnel Division
Wilmington 98, Delaware

WANTED
PRECISION MACHINE DESIGNERS, DRAFTSMEN



MONARCH MACHINE TOOL CO., SIDNEY, O.
Builders of Precision Turning Machines Since 1909

PERSONNEL DIRECTOR WANTED

By old established Company normally employing approximately 1000 in building high grade machinery. Location New York State.

Plant is modern, Company's policies progressive and there is opportunity in congenial surroundings for the right man whose qualifications should include years of successful experience in this field, progressive ideas, sound judgment, ability to assume responsibility, and personality to attract and get along with people.

Business now operating on important war work but has complete line of nationally known products for postwar and normal times.

This is permanent position coordinating all personnel work, including Employment, Labor Relations, Training, Athletic Activities, Safety and Welfare work, Group Insurance and Benefits, etc.

Give full particulars including experience and salary expected.

Correspondence considered confidential.

P-225, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WORKS MANAGER WANTED

In charge of all production functions, one who is capable of getting things done. Supervise purchasing, engineering, time study methods, labor relations, tool and die work, etc. Prefer man with rounded experience and familiar with light manufacturing. A permanent position with long established company with excellent reputation and opportunity for post war expansion, employing over 200. Location middle west. Give complete information and salary expected.

P-241, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

WANTED
METAL SHAPING, FORMING AND FINISHING MAN

Well-versed in problems of shaping, forming and finishing operations. For the right man this position presents an opportunity for unusual service on problems in war plants now and postwar work later on. Nationally known, long established company making materials used in processing and maintenance work. Details of age, experience, salary etc. treated confidentially. If data indicates necessary combination of experience, interview will be arranged at our expense. Location New York, some traveling.

BOX 567, CHURCH ST. ANNEX N.Y.P.O.

WANTED
MACHINE DESIGNER

Exceptional opportunity in a modern, progressive machine tool plant for a machine designer with practical and technical background on medium machinery. Write for personal interview enclosing brief outline of experience to the Chief Engineer.

REED-PRENTICE CORP.
WORCESTER, MASS.

ELECTRICAL ENGINEERING OPPORTUNITY

Electrical manufacturer of nationally known motor control and power distribution equipment offers permanent employment in application and field engineering work to men with electrical engineering education or equivalent experience in sale or design of electrical equipment. Also excellent opportunities for qualified young men without previous experience to receive valuable training in an essential industry having a brilliant postwar future. Give full particulars, including education, experience, age and salary expected. ADDRESS—

P-229, AMERICAN MACHINIST
520 North Michigan Avenue
CHICAGO 11, ILLINOIS

WANTED
MACHINE DESIGNERS

Experienced on the design of special machinery. Excellent opportunity for first class men interested in steady positions in New England.

Only men 35-55 with a record of successful achievements will be considered. In replying furnish information preliminary to a conveniently arranged interview.

P-140, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED
TOOL DESIGNER

Long established company in a New Jersey city 35 miles from New York, requires the services of a tool designer who is able to design without supervision. This is a permanent position with good opportunities. Write full particulars in first letter giving age, experience, lengths of service, and salary expected.

P-215, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED
DESIGN ENGINEER

Must be thoroughly experienced with all types of manufacturing: Die Casting, Production Line Assembly, Etc. Plant located in Metropolitan N. Y. Excellent Opportunity! Permanent Post-War Position! WMC Regulations apply. Give complete record of Experience, Qualifications and salary desired.

P-228, AMERICAN MACHINIST
330 West 42nd St., New York 18, N. Y.

WANTED
PRODUCTION SUPERVISOR

For small plant in medium size Wisconsin city manufacturing precision machinery for over 30 years. Essential war work with excellent peacetime opportunity. Must have machine tool experience, ability to coordinate shop planning, personality to maintain cooperation of all departments. Will report direct to general manager.

P-226, AMERICAN MACHINIST
520 N. MICHIGAN AVE., CHICAGO 11, ILL.

EVERY ITEM GUARANTEED AS REPRESENTED

FALK FOR DEPENDABILITY IN REBUILT MACHINERY

MORE VALUE FOR YOUR MONEY

• • • OUR INVESTMENT IS YOUR SECURITY
• • • SOUND RECONDITIONING

EXCEPTIONAL ITEMS FROM OUR MODERN STOCK*

SHEARS & BRAKES

Lennox Splitting Shear, 8' throat, ¾" cap., arr. M.
Lennox Bevel Shear, ¾" cap., arr. M.D.
Niagara #98 Brake & Folder, 72" cap. 14 ga. arranged M.D.
Niagara No. 6120 Power Squaring Shear, 10' x 10 ga. Motor Drive, 15" gap frame.

PRESSES

#4 Bliss D.C. B.G. Forging 4" stroke.
#4½ Bliss D.C. B.G. Forging 4" stroke (2).
#4½ Bliss 3 column B.G. 3" stroke.
#5 Bliss D.C. B.G. Forging 3" stroke.

BORING MILLS

100" Niles-Bement-Pond Bor. & Turn. Mill. Vertical, 48" Gisholt.
Horiz. #36 Landis-Rochester, 3½ Bar Floor Type—Floor Plate 72" x 120".
42" Bullard Vertical Boring Mill with side head; New Era Type.
54" Colburn Vertical Boring Mill.
No. 31 Lucas Horizontal Boring Mills 3".

DRILLING MACHINES

Cincinnati-Bickford 24", 4 spindle, #4 M.T. Table 20" x 67".
Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle.
Leland Gifford, 2 spindle.
Woodward & Rogers, 6 spindle.
Fosdick 13", 4 spindle (2).
Fosdick 13", 2 spindle.

RADIAL DRILLS

3' Dreses, 9" Rd. Column.
2½' Arm 9" Col. Cincinnati Bickford.
4' Arm 11" Col. Cincinnati Bickford.
5' Arm 11" Rd. Col. Cincinnati Bickford.
5' Arm 13" Rd. Col. Cinn. Bick. air clamp.
6' Arm 14" Col. Cincinnati Bickford.
3' 9" col. American, S.P.D.

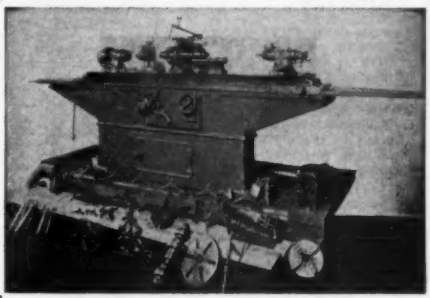
MULTIPLE DRILLS

Fox #15H 54 spindle hydraulic feed.
Natco #D-5, 10 spindles #1 M.T.

GRINDERS

16" Heald Rotary Surface Grinder.
#4 Brown & Sharpe Universal Grinder.
#2 Cincinnati Centerless Grinder, Filmatic.
#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole, 4" dee.
Oliver Model 51 Drill Grinder; 1½" cap.
Pratt & Whitney 14x36 model B vertical surface grinder.
#2 Brown & Sharpe Surface Grinder.
14"x36" Cincinnati Cyl., motor driven.
6"x32" Norton Cyl., overhead c/s drive.

Brown & Sharpe No. 4 Univ. Cylindrical Grinder, M.D., with regular equipment.



Capacity:—Centers swing 12" dia.; over water guards 10¾". Distance between centers 60". Takes wheels to 12" dia. x ½" to 1" thick. Longitudinal Table travel — 10 changes in rate; range 1½" to 53" per minute. Work speed—6 changes for live or dead center grinding. B & S No. 9 taper hole.

MILLING MACHINES

#3, #4 & #5 Cinn., High Power, Plain, S.P.D.
No. 0 Bickett Vertical Bench Miller.
No. 2 Cincinnati, High Power, Plain.
No. 1½ Brown & Sharpe, Plain (2).
#1 Kempsmith Universal, Cone Drive.
No. 1½ Valley City Universal, Cone Dr.
No. 1 Brown & Sharpe, Plain (6).
Ames Precision Universal Bench Mill.
P & W 2½" Duplex Spline Miller.
Hall Planetary Thread Miller 24".
No. 8 Lees Bradner Thread Miller.
No. 1B Hendey Universal, cone drive.

PLANERS

120"x72"x35' Betts, 4 Heads, M.D.
48"x48"x12' Putnam Heavy, 2 Heads, M.D.
30"x30"x12' American M.D., 2 Heads.
30"x30"x10' Cinn. Heavy Pattern, 2 Hds.
20"x20"x36" N.-B.-P., Planer Shaper, M.D.

LATHES

Putnam, 26 x 12 Heavy Q.C.G., arr. for M.D.
American, 16 x 6 Q.C.G., Geared Head.
Hendey, 16 x 10 Q.C.G., Turner M.D.
Potter & Johnston #6A Automatic Chuckers; 3½" dia. hole in spindle (2).
Seneca Falls Tool Room, 14 x 6, Q.C.G.
20 x 10 Lodge & Shipley, G.H., M.D., Taper.
16"x6' Hendey Toolroom Lathe with relieving attachment, taper attachment, draw bar and collets. Geared Head.
16" Warner & Swasey Fox Brass (2).
16" Dreses Fox Brass.
Lodge & Shipley 16" x 8' 12-Speed Selective Geared Head.

SHAPERS AND GEAR CUTTERS

26" Cincinnati Triple Geared, Belt Dr.
#61-2 Fellows 36" Gear Shapers (2).
12" Schuchart & Schutte Gear Hobber.
#1 Adams Gear Hobbers, Belt driven (3).
14" Rockford crank shaper.
No. 2 Baker Keyseater.

BENDING ROLLS

Stoll 4' x 4½" Power Slip Roll cap. 10 ga.

AUTOMATIC DROP HAMMER

Standard Automatic Drop Hammer, 300 lbs. Like new.

MISCELLANEOUS

J. C. Miller Co. Lacq. Heater with acquistat.
Heat Treating Furnaces for the tool room.
Sleeper & Hartley #1 Wire coiling machine for making BX cable.
50 K.W. Moesta Gun Welder Transformer, portable, 25 cy. 440 volts.
Blake and Knowles 12x2x12 Simplex Type, Hydraulic Steam Pump, 2000 lbs. pressure with 80 to 125 lbs. steam, delivers 9 gallons per minute.
#228C Greenlee Vertical Hollow Chisel Mortizer, Power feed, M.D.
No. 7B High Speed Riveting Hammer, cap. ¾" to 1½". New this year.

HEADQUARTERS FOR POWER PRESSES

**The above list, selected from our current stock, is subject to prior sale or subsequent additions. Hence we urge your prompt inquiries on any of these machine tools or others in which you are interested.*

BUY FROM STOCK
Telephone
MAIN 6347-6348

FALK
MACHINERY COMPANY
Machinery Merchants

18 WARD ST.
ROCHESTER 5
N. Y.

ENGINEERED-REBUILT
THE SIMMONS WAY

Every machine listed in this column is in our warehouse at press time.

●

2¼" Bar LUCAS Horizontal Table Type Boring Mill, M.D.
2½" Bar CLEVELAND Horizontal Table Type Boring Mill, M.D.
5" Bar DETRICK-HARVEY Floor Type Horizontal Boring Mill, M.D.
24" BULLARD New Era Vertical Turret Lathe
42" BULLARD, NEW ERA, 1100 serial
42" N-B-P Car Wheel Borer, M.D.
66" N-B-P Vertical Tire Mill
10' CINCINNATI Vertical Boring Mill
4' HAMMOND Sensitive Radial Drill
6' CARLTON Motor-on-Arm, Plain
7' CARLTON Motor-on-Arm, Plain
8' N-B-P Motor-on-Arm, Plain
#16 BLANCHARD Surface Grinder
33"x9" G & E Spur Gear Cutter
27" BRIDGEFORD Axle Turning Lathe
29" PUTNAM Axle Turning Lathe
42" PUTNAM Car Wheel Lathe
#2 CLEVELAND Plain Miller, M.D.
#4 B & S Universal Miller, M. D.
#5 B & S Plain Miller, M. D.
#6 BECKER Vertical Miller, M. D.
#10 N-B-P Heavy Vertical Miller
24"x24"x12' INGERSOLL Plain Miller
24"x36"x12' INGERSOLL Side Miller
30"x30"x10' NEWTON Slab Miller
30"x30"x12' N-B-P Planer, Two Rail Heads, 230 volt D.C.
36"x36"x10' WOODWARD-POWELL Planer, 4-Heads
48"x48"x24' N-B-P Planer, 3-heads, M.D.
60"x48"x12' CINCINNATI Planer, 3-heads
72"x72"x18' N-B-P Heavy Planer, 4-heads 230 volt, D.C.
RT-40 SCHULTZ-NAUMANN Beam Shear
5" Capacity U.E.F. Alligator Shear
72" 105 Tons L & A Multiple Punch
6"x6"x⅝" Double Angle Shear
12" SELLERS Crank Slotter
20" SELLERS Crank Slotter
2" LANDIS Pipe Threader
6" BIGNAL-KEELER Pipe Threader
30' H & J Plate Planer, M.D.

SIMMONS ENGINEERED Machine Tool REBUILDING

SIMMONS MACHINE TOOL CORP.
1759 North Broadway, Albany, N. Y.
N. Y. Office: 50 East 42nd St.

Ready For Shipment

AUTOMATICS:

B & S #00, #0 & #2
Grindley 3¼", 4¼" 1 sp.
Potter & Johnston #6C Chuckers
Gess & Deleeuw Chucker
National Acme #52, #53
Cleveland 2" Model K, 4 Spindle

BORING MILLS:

Cleveland 2½" Bar Horiz.
Bullard 30" Vert. Turret
Bullard 36" Rapid Production
Bertram 42" Vertical
Bullard 100"—2 Head—M.D.

DRILLS:

Niles 7' Radial
Cincinnati-Bickford 6' Radial
Pratt & Whitney Gun Barrel Drills & Rifters

GEAR CUTTERS:

Brown & Sharpe #3—26"
Fellows #64
Fellows Gear Burnisher
Gleason 6" Generator
Detroit Gear Grinders

GRINDERS:

Norton 6x32, 10x24
Baxter D. Whitney #23 Cylinder Grinder, Like New
Brown & Sharpe #11 Plain
Heald #70-A Internal
Heald #72-A-3 Sizematic, New 1940
Blanchard #16-26" M.D.
Norton 15"x15"x72" Surface
Sav-Way Internal
Brown & Sharpe #3 Univ.
Bath 10"x25" Univ.
Cincinnati 12"x36" Univ.
Landis 20"x120", 20"x144" Plain Grinders
Cincinnati #1½ Tool & Cutter
Norton #2 Tool & Cutter
Pfauter Hob Grinder
Bryant #3B, 6, 12, 18 Internal
P & W 14" B.B. Vert. Surface, Model B
Farrel Roll Grinder
Badger #8 Disc Grinder M.D.

LATHES:

Hendey 12"x5'
Monarch 14"x6'
Hendey 16"x7'
LoBlond 14"x6'
Sidney 17"x8'
Johnson 30"x24'

MILLERS:

Cincinnati #5 Plain SPD
Milw. #3B Plain Double Overarm
LoBlond #3GH—Plain
Kempsmith #4 Maximiller, Plain
Brown & Sharpe #10, new 1940
Rice-Barton Spline Millers
Becker #4B Vertical
Cincinnati #3, #4 Vertical SPD
B&S #3 Vertical SPD
Becker Model C, Vert.
Waltham Bench Thread Miller
Rowbottom Cam Miller
P & W 8", 12" Automatic
Pratt & Whitney 2" Spline Duplex
Cincinnati 12" B.G. Mfg. Becker #7H Lincoln

MISCELLANEOUS:

Boring Machine—Coulter Diamond Borer
Chambering Machine—Pratt & Whitney
Chucking Machines—Potter & Johnson #6-C
Hammer—Bliss 300 Lb. Drop
Header—W-F ¾" Ball
Header—W-F #1 & #2—SSSD
Shaper—P & W 6" Vertical
Shear—Marshalltown #88 Rotary Bevel, M.D.
Tapper—Threadnut #2
Swager—Dayton #3½
Thread Roller—W-F ½" cap.
Upsetter—Acme 2" Steel

PLANERS:

Gray 36"x36"x8'
Cincinnati 48"x48"x20', 3 Head
Gray 84"x72"x18', 4 Head

PRESSES:

W-F 20 Ton Rack & Pinion
Robertson 170 Ton Hyd. 16' High

BOTWINIK BROTHERS, INC.
373 Welton St., New Haven 9, Conn.

SEARCHLIGHT SECTION

. . . . (Classified Advertising) . . . .

Employment • Business Equipment

(Used or Resale)

"OPPORTUNITIES"

UNDISPLAYED RATE

10 cents a word. Minimum charge $2.00.
(Not available for equipment advertising)

POSITIONS WANTED (full or part time individual salaried employment only), ½ the above rates payable in advance.

PROPOSALS, 50 cents a line an insertion.

BOX NUMBERS—Care of New York, Chicago or San Francisco offices count as 10 words.

DISCOUNT OF 10% if full payment is made in advance for 4 consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE—PER INCH

INDIVIDUAL SPACES with border rules for prominent display of advertisements.

The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH measures ⅞" vertically on one column, 3 columns —30 inches—to a page.

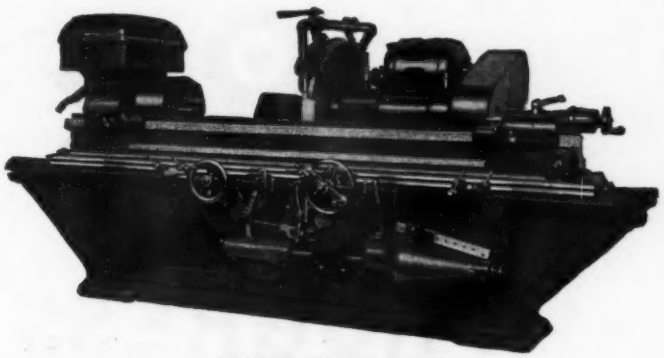
NEW ADVERTISEMENTS received by April 11th will appear in the April 26th issue, subject to limitation of space available. A.M.

If you don't see what you want ...ask for it

If you don't see the equipment advertised that you want, ask for it—ask the advertisers —or we will gladly ask them for you.

Departmental Staff,
AMERICAN MACHINIST

HILL-CLARKE
Modernized
CYLINDRICAL GRINDERS *for* SUPER-GRINDING *and* MICRO-FINISH



SIZES AVAILABLE

10x24	14x36	16x50
10x36	14x50	16x72
10x50	14x72	18x96
10x72	14x96	18x120
10x96	16x30	

Hill-Clarke Modernized and Motorized Cylindrical Grinders offer refinements in design which minimize vibration and assure extreme accuracy on all grinding operations. One of these refinements, the Hill-Clarke patented Multiple V-Belt Drive to work spindle, contributes to the smoothness in operation which makes possible a finish within a few micro-inches even when using standard grain free-cutting wheels.

Send for a copy of our catalog "Super Grinding."

Have you any NORTON grinders you wish modernized and motorized?

HILL-CLARKE MACHINERY CO.

651 WASHINGTON BOULEVARD **CHICAGO 6, ILL.**

#4MS Cincinnati DIAL TYPE Vertical Milling Machine rapid traverse in head

#4 Cincinnati HIGH-POWER Plain Milling Machine

#262 Barnes 26" Sliding Head Upright Drill

#2 Brown & Sharpe Universal Grinder 12"x36", 4-motor drive

Many more. Send us your inquiries.

HAZARD BROWNELL

Machine Tools

350 Waterman St., Providence 6, R.I.

Dexter 8880

MISCELLANEOUS MACHINES

1—36"x36"x12' Cinci. Dbl. Housing Planer, 2 rail hds., 1 side hd., D.C. m.d.

1—56"x56"x18' Cinci. Dbl. Housing Planer, 3 hds., box table, auto. oiled, D.C. vari. speed m.d.

1—6' Niles Plain Radial Drill, rebuilt, gear box, A.C. m.d.

1—3" bar Morris Horiz. Boring Mill, with 5 boring bars, m.d.

1—12"x18" Cinci. Rebuilt Plunge Cut Grinder 18" dia. x 9" face wheel, A.C. m.d.

STRONG, CARLISLE & HAMMOND CO.

1392 West Third St., Cleveland 13, Ohio

Branch Office:

Beard at Chatfield, Detroit 9, Michigan

#3H K & T Sliding Head Vertical Millers, M.D.

1—5' American triple purpose plain radial drill, motor on arm.

#4 Cincinnati High Power Plain Miller, S.P.D.

6' American Triple Purpose Plain Radial Drill, M.D.

HEAVY DUTY MACHINE TOOLS

52" Bullard Vertical Boring & Turning Mill.
54" Colburn Vertical Boring & Turning Mill.
60" Gisholt Vertical Boring & Turning Mill.
60" Betts Vertical Boring & Turning Mill.
5' American Triple Purpose Pl. Rad. Drill.
6' American Triple Purpose Pl. Rad. Drill.
6' Cincinnati Bickford Plain Radial Drill.
7' Cincinnati Bickford Plain Radial Drill.
#4 Cincinnati High Power Plain Miller, PRT.
42" Bullard New Era Vertical Turret Lathe.
#5 Cincinnati High Power Plain Milling Machine.

GRINDERS

12" x 96" Landis Plain, S.C.
18" x 85" Landis Plain Self contained.
#51 Oliver Drill Grinding Machine.

GEAR MACHINERY

18" Gleason Bevel Gear Generators.
6" Bilgram Bevel Gear Generator.
#1 Adams Gear Hobbers.
#1 Schuchart & Schutte Gear Hobber.

PLANERS

96" x 96" x 36' Cincinnati 4 Hds. M.D.

CINCINNATI MACHINERY & SUPPLY CO.

217 East Second St., Cincinnati, Ohio

Miller, Universal, #3 Cincinnati, M.D.
Miller Vertical, #3 B. & S., S.P.D.
Miller & Shaper, #14 Cochrane-Bly, Vert., M.D.
Press, Forging 1000 Ton United, St.-Hyd.
Planer, 36"x36"x12' Powell, 4 Hds.
Profiler, #13 P. & W., B.D.
Shaper, 20"-24"-32".
Shaper, 36" Morton, Draw Cut
Straightener, Sheet 42" W-F M.D.

West Penn Machinery Company

1210 House Bldg., Pittsburgh, Pa.

OTT MACHINERY SPECIALS

AUTOMATICS, Acme, 9/16" Mod. C 5 spd., M.D.
AUTOMATICS, Acme 2 & 3" Mod. B 4 spindle, M.D.
AUTOMATICS, Gridley, 9/16, ⅞ & 1¼" Mod. G.
AUTOMATICS, Cone, 1¼ & 1½" 4 spindle
AUTOMATICS, Gridley, ¾, 1¼, 1¾, 2¼" & 2½" Model F, M.D.
AUTOMATICS Gridley, 2¼, 3¼, & 5¼" S. S.
AUTOMATICS, Cleveland, 1⅛ 1½, 2½ & 3⅛ Model A, M.D.
AUTOMATICS, Cleveland, ⅞, 1¼, & 2" Mod. B
AUTOMATICS, Cleveland ⅞, 1¼ & 1½" Mod. M
AUTOMATICS, New Britain #22 & 24 Chuckers
AUTOMATICS, New Britain, 1⅝ & 2½" 6 spdls., Bar, M.D.
AUTOMATICS, Potter & Johnston #5a & 6a
BORING MILLS, 30" Bullard, M.D.
BORING MILLS, Rockford, 3½" bar, Horizontal, 24x72" table, M.D.
DRILLS, High Speed, B. B. 1 to 6 spindles
GEAR HOBBERS, 12 Barber-Colman, M.D.
GEAR SHAPERS, #7 High Speed, M.D. & #6.
GRINDER, Brown & Sharpe #2 Universal M.D.
GRINDER, Brown & Sharpe #5 Plain, M.D.
GRINDERS, Cincinnati 12"x18" Plunge Cut
GRINDERS, Bryant #3 Internal, M.D.
GRINDERS, Rivett #103 Internal, M.D.
GRINDERS, Diamond Surface #2, M.D.
GRINDERS, Landis Hydraulic, 6x18" M.D.
GRINDERS, Pratt & Whitney, 14" Vertical Surface, M.D., 9x31" Magnetic Chuck
LATHES, American 14x6' & 20"x8', M.D.
MILLING MACHINES, #2 B. & S. Universal, M. D.
MILLING MACHINES, #2B Rockford Universal, M.D.
MILLING MACHINES, Becker Vertical #5 & 6
PLANER, Ohio 42"x42"x12' One Head, M.D.

OTT MACHINERY SALES, INC.

542 Second Avenue

Detroit 26, Mich.

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Industrial problems are constantly being studied by the Machinery Dealers National Association to aid the industry in better serving its customers.

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RANDOLPH K. VINSON, *Executive Director*
20 North Wacker Drive **Chicago 6, Ill.**
Chapters in Principal Industrial Cities

HORIZONTAL BORING MILL
4" BAR
Condition Like New
Make—Universal Boring Machine Co.

30" Traverse of Spindle, continuous
60" Traverse of Spindle, one resetting
96" Max. distance face plate to outer support
60" Max. distance table to center of spindle
49" x 79" table; working area 42" x 72"
60" power cross feed to table

Verniers on head post and cross travel, many other extras—motor driven

REYNOLDS MACHINERY CO.
211 Eddy Street
Providence 3, R. I.
(Gaspee 5187)

FIVE (5) AUTOMATIC SCREW MACHINES

Six (6) Spindle New Britain—One Model 172—1" x 5"—Serial No. 10213—Push type collets. Four Model 206—1⅝" x 7"—Ser. Nos. 5920 & 6933 with p. t. collets; Ser. Nos. 22316 & 23121 with Draw in type collets. All motor driven (220-440V. AC) equipped with drill chucks, extra collets and Feed Fingers for round stock, tooled and now operating, in good condition and turning out spark plug shells (hex. stock). Motor ratings: Model 172—3 h.p. 206—7½ h.p.

BOWERS BATTERY & SPARK PLUG CO.
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EX-CELL-O
Thread Grinder

Internal—Style 39A
New—1944—Used—2 Months

Wigglesworth Machinery Co.
203 Bent Street
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84" King Boring Mill
2-Spindle No. 2 Avey Drill, M.D.
No. 5 Cincinnati Plain Mill, S.P.D.

MDNA MEMBER

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47 Laurelton Road, Rochester 9, N.Y.

PLANER

72" x 56" x 16' Gray 4 heads. M.D.

AARON MACHINERY CO.
45 CROSBY STREET NEW YORK, N.Y.

4" Bar Lucas Horizontal Boring Mill, M.D.
5" Bar Newark Horizontal Boring Mill, 8' Bed, M.D.
3—#7 Fellows Gear Shapers, M.D.
#17 Barber Colman Heavy Duty Gear Hobber, can take a hob up to 5¾" dia., M.D.
10x30 Norton O.D. Grinder, self contained, 10 yrs. old
8" Bullard Mult Au Matic, 12 spindle
#40 Cross Gear Tooth Rounder, M.D.
#3, #4 Horiz. and Univ. Milling Machines, M.D

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MDNA MEMBER
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Complete Diesel Power Plant
Rated capacity 390 KW, made up of 3 units with 160 H.P. Chicago Pneu. diesel engines and complete with switchboards and all accessories.
IN FIRST CLASS CONDITION!!!
IRON & STEEL PRODUCTS, INC.
13498 S. Brainard Ave., Chicago 33, Illinois
"Anything containing IRON or STEEL"

FOR SALE
600 TON HYDRAULIC PRESS
Watson Stillman rebuilt 48" single daylight opening, downward double acting ram 16" dia. by 21" stroke, platen 24"x24" with clear space left to right 30¾" between 5⅛" dia. strain rods. We will purchase your Surplus Equipment.
UNIVERSAL HYDRAULIC MACHINERY CO.
285 Hudson Street New York, N. Y.

PRICED EXCEPTIONALLY LOW FOR IMMEDIATE DELIVERY

FORGING PLANT

5" Ajax Horizontal Upsetter
2—R.D. Wood Hydraulic Forging Presses 2500 & 3000 Ton
2—Horizontal Bolt Headers—1" & 1½"
6—Steam Drop Hammers—100, 500, 600, 1100, 1500, 3600 lb.
2000 lb. Steam Hammer
#57 & #58 Toledo Straight Side Geared Trimming Presses
#73½ Bliss Straight Side Geared Trimming Press
25"x5"x18" Horizontal Hydraulic Pot Valve Plunger Pump
16"x26"x7"x18" Horizontal Hydraulic Pot Valve Plunger Pump
22"x11"x18" Horizontal Hydraulic Pot Valve Plunger Pump
18"x4"x18" Horizontal Hydraulic Pot Valve Plunger Pump
R.D. Wood Accumulator 32" dia. x 18" stroke 600 gal. cap.

LATHES

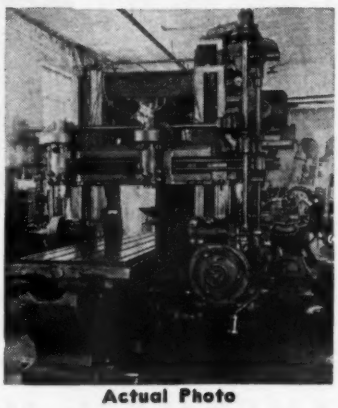
48"x80"x24' bed Fitfield D.B.G.
30" Houston, Stanwood & Gamble. Blocked to 58" x 17' M.D. 10 HP Motor with grinding attachment and other parts Q.C.
36"x14' Engine Lathe, B.G. M.D.
36"x18' Schumacher & Boye Q.C. Lathe, M.D.
22"x16' Prentice Gearod Head, Q.C.G. S.P.D. M.D.
24"x12' Putnam Blocked to 28" D.B.G. MD..
16"x8' Pratt & Whitney M.D.
13"x22"x5'x8' Barnes Gap Lathe Standard Change
14x20" No. 9 Lobiond Multi Cut Lathe S.P. Geared Head
2—36"x14' Niles-Bement-Pond G.H. M.D. Taper Attach.
1—36"x16' Niles-Bement-Pond G.H. M.D. Taper Attach.
1—42"x18' Niles-Bement-Pond G.H. M.D. Taper Attach.

MILLERS

No. 5 Cincinnati Hi-Power Universal, S.P.D.
No. 4 Cincinnati Universal, 3 step D.B.G. M.D.
No. 4 Cincinnati Hi-Power Plain S.P.D.
No. 4 Cincinnati Plain, 3 step D.B.G. M.D.
No. 4B Brown & Sharpe Plain, S.P.D. M.D
No 4 Milwaukee Plain Standard Knee Type Horiz. M.D.
No. 3 Cincinnati Plain Miller, D.B.G.
No. 3K Milwaukee Plain, M.D. Dial Type 1939 Model
Model C Beeker Vertical, P.F. to rotary table M.D.
No. 2 LeBlond Plain Back Geared, M.D.
Pratt & Whitney Automatic Miller P.F. to table
No. 12 Brown & Sharpe Prod., M.D.
No. 7 Becker Lincoln Type
No. 2A Brown & Sharpe Universal
No. 2 Brown & Sharpe Vertical, P.F. to table, M.D.
No. 0S Cincinnati Vertical, M.D.
A.B. Becker Vertical, S.P.
No. OY Brown & Sharpe, P.F. to table
No. 3 B. & S. Miller
No. 2A B. & S. Universal, M.D.
12"x48" Pratt & Whitney Thread Millers.

SHAPERS

24" Gould & Eberhardt, B.G. M.D.
20" Steptoe, Gould & Eberhardt, Hendey M.D. S.P.
18" Juengst, Springfield M.D.
16" Flather Smith & Mills, M.D.
20" Hendey, S.P. M.D.



Actual Photo

36"x36"x10' Ingersoll 4 Head Miller, Planer Type with adjustable rail, adjustable heads and adjustable Spindles

AUTOMATICS

Nos. 00-0 & 2G Brown & Sharpe
No. 00G Brown & Sharpe High Speed
New Britain 1⅝" 6 Sp.
No. 23 New Britain Chuckers, 5½"
4—1¾" Gridley, M.D.

BORING MILLS

Sellers Vertical, 100" M.D. 1931
Niles Horiz. 2¾"

GRINDERS

10"x36" Norton Cyl.
#13 Brown & Sharpe Cyl.
Pratt & Whitney Vertical, 14" M.D.
Bridgeport Knife Grinder, M.D.
Springfield Vertical, S.P. M.D.
No. 70 Heald Internal, M.D.
Heald Rotary, 9' Magnetic Chuck, M.D.
No. 11 Brown & Sharpe
No. 2 Brown & Sharpe Surface
No. 4 Gallmeyer & Livingston Universal Tool & Cutter, M.D.
Taylor & Fenn Internal, Cushman Chuck
No. 1G Abrasive, Internal

PLANERS

72"x72"x26' Sellers 4 heads, M.D.
42"x42"x10'x12' Gray 4 Heads
36"x36"x10' Gray 4 Heads
24"x24"x5' Pond, 1 Head, Cone Driven
36"x36"x15' Niles-Bement-Pond, 4 heads, M.D.

PRESSES

No. 60¼ Power 1200 ton, 22" Stroke, 75 HP. Motor
2—Watson-Stillman Hydraulic 600 & 1000 Tons
Farnham Hydraulic, 250 tons, 4 Post, 4" Dia.
MISCELLANEOUS SMALLER TYPES AND SIZES IN STOCK

POWER SHEARS & BRAKES

Adlerhurst Punch & Shear, 1"x6", 25" Throat
Peis Punch & Shear No. 20
8' Niagara, 14 Ga. Gap
6' Steil

MISCELLANEOUS

William Laidlaw 30" Bandsaw, M.D.
Robinson Power Press Brake 8' 16 Gauge
3 Head Bliss Metal Forming Rolls, Heavy Duty
3 Head Rafter Metal Forming Rolls
5 Head Duplex Metal Forming Rolls
No. 0 Baird Header Machine, motorized
No. 2 Waterbury Header
36" Corrugated Machine
Acme Bolt Cutter, M.D. 1½"
10" CAMPBELL CUTAMATIC, 1943

TURRET LATHES

Bardons & Oliver, 4" M.D.
Gisholt Tilting, 24" Swing, M.D. 8"
Smur & Kamen 1¼" M.D.
No. 4 W. & S. Universal
B. & S. No. 6, 2" Capacity
4"x34" J. & L., Steel Head, 1930

RADIAL DRILLS

6' Cincinnati-Bickford, S.P. 16" Col.
3' Cincinnati-Bickford S.P. 9" Col.
4' Dreses, 4 step cone.
3' Niles, 10" col., D.B.G. M.D.

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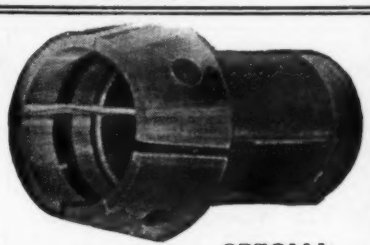
Telephone WOrth 4-5140

USED COLLETS
FEED FINGERS — PADS



ACME No. 515, No. 52, No. 53, No. 54, No. 55, No. 56.
ACME-GRIDLEY 1⅜".
Cleveland ⅞" to 2½".
Cone 1¼", 1½", 2½".
Foster No. 1, No. 2, No. 3, No. 4, No. 5, No. 7.
Gridley, Models F, ¾", ⅞", 1¼", 1⅜", 2¼", 2⅜", 3¼", 4¼".
Model "G" Gridley, ⅞".
No. 4 & No. 6 Warner & Swasey.
Bardons & Oliver, Brown & Sharpe, Davenport, Garvin, and ⅝ x 5 New Britain.
Change Gears, Lead Cams, Form Cams, No. 53 to No. 56 Acme.
Form & Lead & Cut-off Cams for ⅞" G. Gridley.
Spindle gears, finger holders, collet tubes, push tubes, spindles, nose pieces for 2⅛" F. Gridley.
Large stock 1⅜" F. Gridley Collets.

SPECIAL
Master Collets and Master Feed Fingers for 4" Cone Automatics.

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GRAFF MACHINE TOOL COMPANY
7140 So. Halsted Street — Vincennes 9664 — Chicago 21, Ill.

LUCAS of BRIDGEPORT

offers the following:

NINE 10"x18" NORTON GRINDERS
Type BA Plunge-cut plain cylindrical, Motor drive

NO. 2 PRATT & WHITNEY
Jig Borer

NATCO MULTIPLE SPINDLE
Drill Press, Model C-7

INGERSOLL PLANER MILLER
42"x34"x8', Motor drive

TOLEDO GANG SLITTER
No. 645 Heavy Duty

NO. 3 BARRETT HORIZONTAL
Boring Mill, 6" Bar

MACHINE TOOLS
NEW—USED—REBUILT

J. L. LUCAS & SON, INC.
BRIDGEPORT 5 — CONNECTICUT

SEND FOR OUR SPECIAL PRICES OF PRECISION TAPPER GROUND TAPS

High speed tapper taps, bent and straight shank. Sizes ranging 3/56 to 10/32 in 90° bent shank. Sizes ranging ¼-28 to ½-20 NF in 90° & 180° bent shank. Sizes ranging ¼-28 to ¾-16 in Acme and straight shank 15" overall. ALL GOOD STANDARD BRANDS FOR IMMEDIATE DELIVERY.

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173 GRAND STREET, NEW YORK 13, N. Y.
SEND US YOUR INQUIRIES

FOSDICK 3½' Radial Drill, G.B., M.D.
WOODWARD & POWELL 30"x30"x8' Metal Planer, 1 rail head, 1 side head.
MITTS & MERRILL No. 6 Keyseater, M.D.
MARVEL No. 8 Metal Cutting Band Saw, cap. 18"x18"
MILWAUKEE No. 2-B Double Over-Arm Plain Miller, Motor Drive.
Available Immediately. Also Many Other Tools
ALEX ZEEVE & Company
2269 Woolworth Bldg. New York 7, N. Y.

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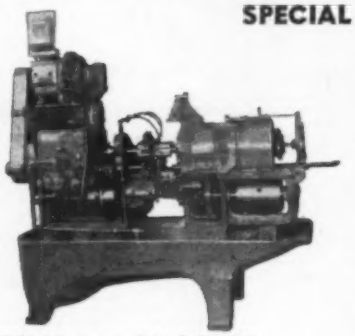
SPECIAL



2-9/16" Acme Model "C"
5-spdle. Automatic Screw Machine

Each machine complete with 7 1/2 H.P. AC motor

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J. L. LUCAS & SON, INC.
BRIDGEPORT 5 CONNECTICUT

AIR COMPRESSORS

1—Model A-8 3"x2½" Quincy (new)

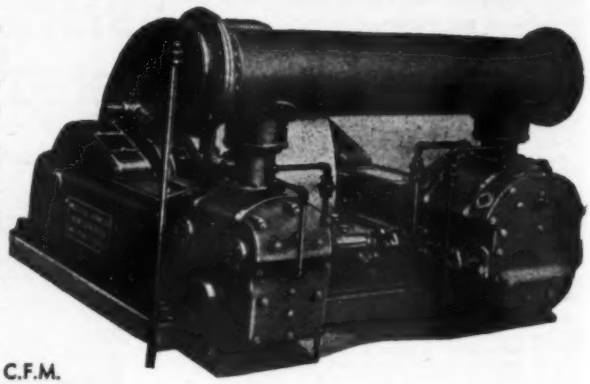
2—Model AA-12 2½" x2½" Quincy (new)

1—Ingersoll Rand Gas Engine 105 C.F.M.

1—Ingersoll Rand 8½" x 4½" x 10" 106 C.F.M.

1—Ingersoll Rand 12" x 7½" x 12" 327 C.F.M.

1—Bury Type BP4H 15" x 9" x 12" 546 C.F.M.



1—Sullivan Class WJ3 788 C.F.M.

1—Chicago Pneumatic 22" x 14" x 16" 1055 C.F.M.

IN OUR STOCK
AVAILABLE FOR IMMEDIATE DELIVERY

EMERMAN MACHINERY CORP.
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SHEET METAL MACHINERY

NEW and USED—Hand and Power Brakes, Shears, Forming Rolls, Folders, Punches, Rotary Machines, Stakes, Spot and Arc Welders

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PIPE New & Reconditioned

ALL SIZES for ALL PURPOSES
Cut and Threaded to Your Specifications
VALVES AND FITTINGS

UNITED PIPE & SUPPLY CO., NORRISTOWN, PA.

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Model Pld. #2836 Lithdraw Furnace, Pit Type Normalizing furnace. 89" dia. x 65" high.—Heated area — 28" x 36" — Temp. Range 800° F. Min. to 1700° Max.

Complete with Controls, instrument panel and blower 1 year old—Actual use—6 mos. Price $8,000.00—F.O.B. Meadville, Pa. Our Plant. Condition—Like New.

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LARGE LATHES

84" Niles-Bement-Pond, 28' long, 17' centers, 72" geared face plate DC drive

32"x35' Wickes Grd. Hd., M.D.

36"x30' LeBlond Grd. Hd., M.D.

36"x30' Putnam Grd. Hd., M.D.

42"x16' Putnam, M.D.

36"x22' New Haven Geared D.C. M.D.

30"x26' Lodge & Shipley 12 speed Geared Head, M.D.

AARON MACHINERY CO.
45 CROSBY STREET NEW YORK, N.Y.

BORING MILLS—(Vertical)

38" Colburn, Gear Box, Single Turret Head, for motor drive. (late model.)
42" Gisholt, 1-swivel head, 1-Turret head. Motor 3/60/220 volts.
60" Niles, 2-swivel heads, Link belt, four speed Transmission, for motor drive.

BORING MILLS—(Horizontal)

3-A. Detrick & Harvey, 6" bar, for motor drive.

PLANER

72" wide x 84" high x 14' Gray, Heavy pattern, for motor drive.

PRESS—Knuckle Joint

1500 Ton, 29 Bliss; stroke 4", 40" bet. Hsgs.

TURRET LATHES

2-A Warner & Swasey G.H., Universal, 3⅛" hollow spindle, 3-jaw chuck. Ser. # 189983. Reconditioned.
28"x7½" Libby-International G.H., P.R.T., 22" 3-Jaw Univ. Chuck, Taper Attachment. For motor drive. Ser. # C-7-7312.
1½" Milholland, Geared Head, S.P.D., P.F. to turret, bar feed and collets; hand cut-off.

GALBREATH MACHINERY CO.
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POWER PRESSES

BLISS, TOLEDO, V & O. ETC.
REBUILT — GUARANTEED

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JOSEPH HYMAN & SONS
Tioga, Livingston and Almond Streets
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FOR SALE

DEEPFREEZE Cold Treating Unit Cascade Model F 120 complete with 220 volt, 3 phase, 60 cycle motors and Dickson Recording Thermometer. LATEST MODEL — NEW July, 1944.

WISCONSIN KNIFE WORKS
BELOIT WISCONSIN

FOR SALE

1—6 ft. Dreses plain radial 15" column.

1—6 ft. Universal radial 14" column, cone pulley drive.

1—3 ft. rebuilt Bickford radial with Vari-Speed motor.

1—20" Royersford reversing drill, 8 speeds with motor drive.

Zallea Brothers & Johnson
Taylor & Locust Streets
WILMINGTON, DELAWARE

LATHE

One #1H-6 F.C. Heavy Duty Libby Lathe, 6¼" hole through spindle, swings 24" over the ways, and 22½" over turret carriage, equipped with 18" 3-jaw universal chuck, also 18" faceplate. Has taper turning attachment for a length of 20", and is equipped with 15 H.P., 2-speed motor, 220 Volt, 3 Phase, 60 Cycles, with which 16-spindle speeds can be obtained ranging from 5 R.P.M. to 225 R.P.M. Machine purchased new January 1943.

THE HARTFORD SPECIAL MACHINERY CO.
Hartford 5, Conn.

MOREY
Dependable Used Machines

BULLARD 24" Vert. Turret Lathe—with side head; R.P.
LANDIS 20"x220 Plain Cyl. Grinder—M.D.
GLEASON 3", 6", 11" Bevel Gear Generators—2 tool type
GLEASON 10" Spiral Bevel Gear Generator
GLEASON 15" Spiral Bevel Gear Generator
INGERSOLL 24" Cutter Grinder
INGERSOLL 26"x26"x12' Planer Type Miller
P. & W. 6"x14" Thread Millers
SAUNDERS 8-18" Pipe Threader
TREADWELL 12" Pipe Machine

LATEST TYPE MACHINE TOOLS — Built in 1942

DEFIANCE #25-A Horiz. Boring Mill—3¾" bar
GLEASON 12" Straight Bevel Gear Generator
GLEASON 3" Straight Bevel Gear Generators
MOREY No. 2G Plain Turret Lathe—1" cap.
MOREY No. 3 Univ. Turret Lathe—1½" cap.
MOREY No. 12M 2 spindle Vertical Profiler

ALL MOTOR DRIVEN AND INCLUDING 3 phase, 60 cycle, 220 volt, A. C. motors

GISHOLT Precision Balancer
ESPEN LUCAS #138 Cold Cutting Saw—Cap. of blade 12"
SLEEPER & HARTLEY Coil Winder
CINCINNATI Gear Burnisher

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410 BROOME ST., NEW YORK

UNUSUAL VALUES

Brake, Robinson 5' toggle
Brake, Chicago steel, 3'
Drill, high speed 7" over hang single spindle
Drill, two-spindle sensitive, #1 Morse taper
Drill, Bickford 42" radial
Drill, 4-spindle sensitive
Grinder, LaSalle Surface
Hammer, 50# Bradley upright, helve
Lathe turret #9 Bardons & Oliver
Pipe Machine 8" Oster motor drive
Planer, 30"x30"x10' Gray; 2 heads, motor drive
Planer 24"x24"x6' Pease, motor drive
Press #1 OBI motor drive
Punch & Shear two ½" & ⅝" capacity
Shaper 24" Gould & Eberhardt
Threading Machine #0 Webster & Perks
Tool Grinder Sellers new #0, #1 and #2 magic chuck and collets.

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COLUMBUS, OHIO

CLOSEOUTS

BORING MILLS
HORIZONTAL
2½", 4" Binsee
4" Landis Horiz., Floor Type, M.D.

VERTICAL
66", 120" Niles
42" Bullard, M.D., 54" Colburn, M.D., 2 hds.

TURRET LATHES
Nos. 2A, 3A W.&S., 4½" hole, M.D.
24" Gisholt, 6½" hole
Foster Nos. 4, 5, 6, 1B, M.D. Univ.
J. & L. 2¼x24", 3¼x36"

GRINDERS
P. & W. 14", 18", B.B., Vert., M.D.
Blanchard 30", M.D.; Modern 12x48", M.D.
Norton Hydraulic 12x18", M.D.
Heald Nos. 55, 70, 72A3 Gagematic, M.D.
Norton 50"x28", M.D.
Gardner 72' disc, M.D.
Landis Type A 6x20" Hydraulic, M.D.
Bryant No. 12, M.D.
Nos. 50, 55, 60 Heald Int. Hydraulic, M.D.
12" Heald Rotary, M.D.
B. & S. No. 2 Surface, M.D.
Norton 10x36" Hydraulic, M.D.
Badger 24" Dbl. Opposed, M.D.
B. & S. No. 10, 11 Cyl.
No. 2 Cincinnati, Centerless, M.D.
B. & S. No. 1, 3 Universal

LATHES
McCabe 26-42"x14'
24x12' Boye & Emmes 3 step cone, D.B.G.
20"x14' Rahn-Larmon, raised to 24"
14"x6' Hendey
9" LeBlond Automatic
36x30' Putnam, M.D.
36x30' Putnam S.C.G., D.C.M.D.
36"x30' LeBlond, M.D. 32"x35' Wickes
Putnam 42x16', M.D.
30x26' L. & S. 12 speed M.D.
21x14' Sidney Q.C.G.
84"x28' Niles Bement Pond, 17' centers

AUTOMATICS
B. & S. No. 2, 6, 6S Hand Screw
B. & S. No. 00, 0, 2 G
5 Spdle. Davenport ½" cap.
Cleveland Model A ½", ⅝", 1¼", 2"
Cleveland Model B 1", 2"
Cleveland ⅞", Model M, 4 spindle
Gridley 4¼" single spindle, M.D.
P. & J. 6A, M.D.

GEAR CUTTERS
No. 2, 3, 12 Barber-Colman Gear Hobber
No. 6 Fellows Gear Shapers
B. & S. No. 3-26", 4-36"
Gleason 11" Bevel
Pfauter No. 0, M.D.

SHAPERS
20", 24" G. & E., 20" Ohio, M.D.
16", 20", 26" Stockbridge

RADIALS
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5' Dreses Full Universal
3', 3½' Cincinnati-Bickford
4' Mueller, M.D.; 4', 5' Western, S.P.D.

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Nos. 1Y, 0Y, 3, 4, 5 B. & S. Plain & Univ.
B. & S. Nos. 12, 13, 13B
Hall Planetary Model D Thread Miller
Providence Planer Type 32"x8'
Becker Nos. 3, AB, 5, 6 Vert.
Nos. 3, 4, Cincinnati Vert.
P. & W. No. 12, 30 Profiler, M.D.
No. 4 B & S. Universal
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Milwaukee No. 2½B Vert.

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Gorton No. 18 Engraving Machine
6 spindle Avey Drill, 15" overhang
800 ton coining press: McCabe ½" Flanger
Rochester No. 5B Hammer
Pels 6" Vert. Shaper
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No. 75 Heald Internal
Heald No. 72 automatic electric sizing Internal
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10"x24" No. Brown Sharpe univ.
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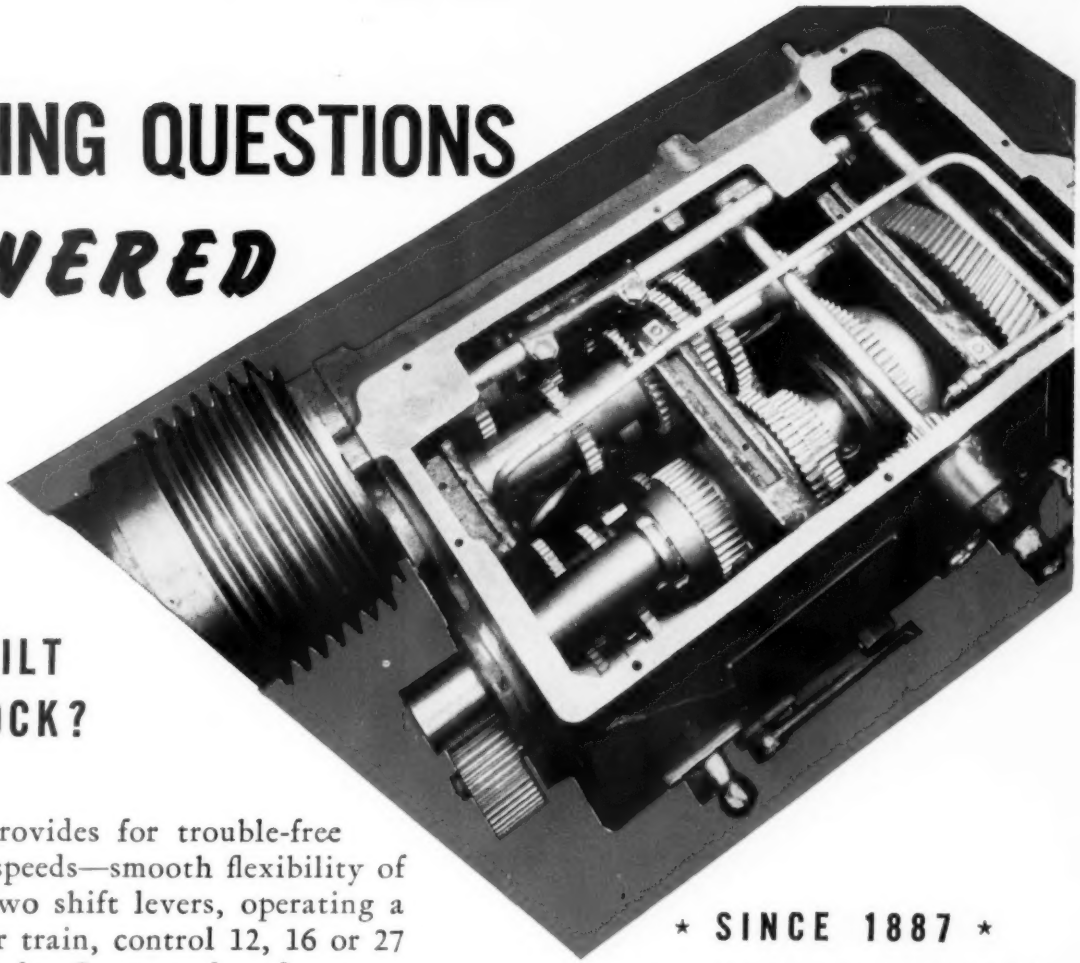

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